November 1994 Issue #39

Radio Fun

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"The beginner's guide to the exciting world of amateur radio."

in this issue

features

reviews

departments

FCC Slaps VEs, Cancels Upgrades

The Federal Communications Commission has begun proceedings against three suspended volunteer examiners and has downgraded 51 amateur licensees after an extensive fraud investigation in Southern California. According to the *Westlink Report*, Extra Class licensees James B. Williams AA6TC of Wilmington, CA, Robert L. Flores N6WPQ and his wife Rose Marie Flores N6WPR of Santa Monica, CA, were ordered to turn in their licenses. The FCC believes all three conspired to commit fraud in at least one instance in violation of the rules and regulations governing participation in the volunteer testing system.

The FCC has also acted to punish 51 hams who either refused to take retests or failed their new exams as part of the agency's ongoing investigation. Investigators say at least one test session never actually took place. Indications are that this is just the tip of a very large iceberg, and more disciplinary actions by the FCC may be forthcoming. *TNX Westlink Report, No 682, October 13, 1994.*

Kid Power

Carole Perry WB2MGP is looking for good speakers under the age of 18 to be presenters at the Dayton '95 Youth Forum. Children should contact Carole for an interview. Her address is at the top of her column "What's Next?" on page 24. Or phone Carole at (718) 983-1416.

Carole would also like to encourage adults to bring a child or young adult to the Hamvention. Support the future of ham radio!

Dial FCC Toll-Free

The Federal Communications Commission has installed a new toll-free telephone service at Gettysburg, Pennsylvania. The 800 number is now available for customer service inquiries at the licensing division.

The number is **(800) 322-1117,** weekdays from 8 a.m. to 4:30 p.m. Eastern Time. It gives you access to an automated system which will record your requests for forms and records, complaints, and requests for information.

The commission instituted the new number after a presidential order that the federal government be "customer driven." The FCC conducted research to determine the need for the 800 line. Within the next year and a half, the FCC plans to institute other customer service improvements to comply with the White House directive. *TNX Florida Skip, Vol. 36, No 10, October, 1994.*

Sunset Setup!

Members of the Maple Ridge Amateur Radio Club use the last bit of daylight to install another antenna in Pitt Meadow, B.C., Canada. (Photo courtesy Terry Goodwin VE7TAG.)

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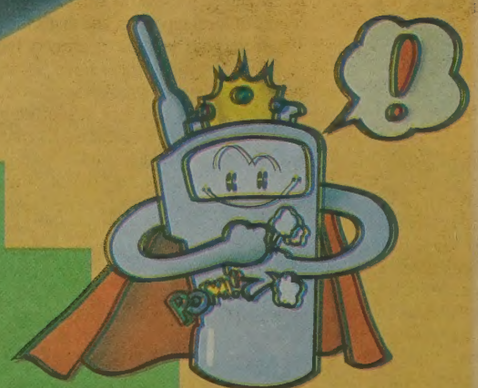
CMP115	Mini speaker microphone
CNB401	NiCad battery pack
CSA401A	NiCad battery charger



FCC APPROVAL PENDING

For more information on the C108A and other STANDARD products, please contact your nearest STANDARD dealer. Specifications, features and price are subject to change without obligation or notice.

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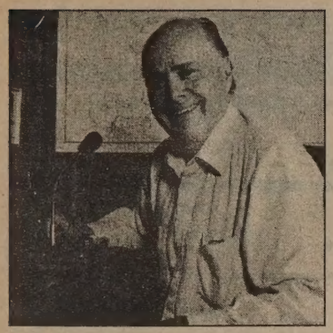


QLF

by Wayne Green W2NSD/1

Join the Revolution

Isn't it about time for Techs to get some decent low-band frequencies? Well, are you game for a stiff fight with the ARRL? For what I'm going to propose will be vigorously opposed by the League.

The only element separating the Tech from the General Class license is that 13-per code test. Now that the code is being phased out of commercial and military communications, about the only ones left using it are a few amateurs. I can hear the left-wingers now: "Wayne hates Morse code." And, "Wayne hates the League." Oh fap, I don't hate the code, I just think that it should be used because it's fun and not have it jammed down our throats by the League. And I particularly don't think it should be used as the primary obstacle aimed at keeping newcomers from getting ham licenses. This is supposed to be a technical, not a skill, hobby. Most idiots can learn the code.

The code is an anachronism. It's antique and should be preserved by code-lovers because of its antiqueness. But we should stop using it as the main way to keep out new hams.

My proposal to solve this the simplest way is to petition the FCC to get rid of the no-longer-needed Technician-Plus Class of license by changing all Tech-Plus licensees to General Class. Since the ITU only requires a "knowledge of the code" I'm agreeable to allowing a 5 wpm test to demonstrate that knowledge. But please remember that anyone who has merely memorized the code can copy at 5 wpm. All you have to do is write down the actual dots and dashes as they are being sent and then, in your own sweet time, decipher them.

That 13-per requirement has kept millions of potential hams from getting their licenses. And this, in turn, has seriously held back our growth, and our ability to invent and pioneer new communications modes.

Sure, a code test made sense back when I got my ticket over 50 years ago, back when 90% of all ham communications was via CW. But that was back before VFOs, even before most hams could afford phone rigs. That was way back when 40m CW was the main workhorse ham band.

As I've mentioned recently, there are now digital communications systems which can pass more traffic in a few minutes than has been passed on CW in amateur radio in the last 75 years. Indeed, few amateurs are still using hand keys. Many CW ops these days are generating the code with a computer, which is also reading it for them. Maybe we should ask the FCC to let us use our computers to pass the code test? No, let's get rid of the no-longer-relevant Technician-Plus license and grandfather all Tech-Pluses to General Class.

How Do We Do It?

You've got a mighty big selling job to do. I guarantee the ARRL old-timers will fight this bitterly . . . or at least until they see that they have more to lose by fighting than they're winning by stopping change (a.k.a. progress). No, I don't hate the ARRL. Heck, I don't even hate Clinton. I don't respect him much, nor do I respect some of what the ARRL directors have been doing. I do respect most of the ARRL HQ staff...and many of them are frustrated by the actions of the directors.

You can start by organizing a petition for this rule change and getting it signed by members of your local ham club. You can set up a table at hamfests and get signatures. We need thousands of signatures to wave at the FCC Commissioners. You can talk it up on the air and get others to pass petitions around at their club meetings.

Please be sure to send me copies of your petitions so I can include them in my petition for this rule change.

What's the Difference?

If you're a Tech, you may be so used to being stuck up on 2m that you don't know what miseries we've got waiting for you on the low bands. You may not be aware of the vicious pileups when rare DX has the stupidity to get on the air. You may have missed out on the revoltingly mindless ham behavior on 14,313 or the seemingly endless ego-inflated broadcasts by a Mainiac on 14,275.

On the bright side, there are around 400 countries you can work, if you decide to become a DX nut and rut around 15 and 20m. In a couple of hundred of these countries you'll find hams who are actually interested in talking with you and who, if you give them even half a chance, would love to become friends. Before long you'll be a geography whiz and know the location of just about every little island in the South Pacific. Heck, in the world. One of my calls is 7P8CA, so where was I operating from?

Or you may get caught up in slow-scan TV or RTTY. These are both seriously addictive, and both tend to lead to your learning more than you ever thought you would about this ham stuff. Of course the worst part is that once you taste of the fruit of the DX tree you're going to be hooked and have to move on to an Advanced Class license. And that means either you're going to have give up and learn the code or else convince the FCC to come to grips with the realities of communications in the late 20th century and grandfather Generals into the Advanced Class license. Unless the ARRL directors organize an execution squad in my honor, I'll be out there in front, waving the flag and asking why am I all alone out here?

The Wayne Green Plot

I suppose I shouldn't tip my hand, but what I have in mind is gradually getting our hobby out of this dumb hierarchy of license grades. I'd like to see it where you have a license or you don't, and once you do you can operate using any mode you want on any band you want. This whole bunch of nonsense started out in the early days when it was thought that gee, phone transmitters are more complicated than CW rigs, so we should have special radiotelephone licenses for operating on phone. That was when we got the Class A license, and that was so long ago that it was even before I got into the hobby. Class B was for us peons using CW. Oh yes, we were allowed to use phone on 160m, because that was a crummy, QRM-jammed short-distance band. And on 10m, because that was the microwaves of the day.

The first ham I ever met was Harry Stevenson W1CUN, and he was a pioneer on 10m back in 1933. I inherited his old *QST* magazines and found his 10m exploits cited in them. When I got fired as editor of *CQ* in 1960 the publisher refused to give my *QST* collection back, so as far as I know my old magazines are still there. Yep, 34 years later and I'm still bitching. And, while I'm at it, how about sending back my 1958 Navassa DXpedition slides too? Grumble.

The Class A ticket, which did not require a higher code speed, did test on radiotelephone technology. That gave one a 100 kHz phone segment on 75m and another on 20m. Those were the AM phone days, so each of these phone bands really had room for only nine contacts at any one time. On 75m this meant nine round tables, each controlled by some rich ham with a kilowatt rig. Yes rich. A kilowatt modulation transformer ran around $25,000 or so in today's dollarettes.

I didn't bother getting my Class A license until after WWII when surplus gear made it cheap to build a KW rig. Then I built an all-band rig with a pair of 813s and had another for just 75m with a pair of 203Zs. Plus one for 2m with 4-125As.

Then a ham got to be an FCC Commissioner and, despite everything the ARRL could do to prevent it, we got the Novice license. And the Extra Class. And Tech. I frankly don't see any excuse these days for our having anything but one class of license. We've made the tests easy and we give away the answers in Q&A books, so newcomers don't really have to know much.

I look on the ham license as a ticket to have fun and learn. It's a way to attract youngsters into the hobby and get them started on high-tech career paths. I hope you'll agree that in this technological age America needs all of the technicians, engineers and scientists we can generate. If you get involved with packet you're going to learn. If you decide you're going to work 350 countries, you're going to have to learn a lot about radio and antennas. Ditto when you get sucked into RTTY, AMTOR, Clover, satellites, and so on. And if you don't learn, you are cheating yourself as well as the rest of us.

So what do you say, are you with me on combining the Tech and General privileges? I'd love to have you come back to one of my "CQ" calls on 20m some day.

Here's All You Need for Your Petition

"The undersigned hereby petition the FCC to reduce the code requirement for the General Class license to 'a knowledge of the code' 5 wpm, thus completely eliminating the need for the Technician-Plus Class license. The present holders of the Technician-Plus Class license to be grandfathered to General Class." Please sign name, call letters, and address. RF

Are You a Newcomer?

Welcome! About 25% of the *Radio Fun* readers this month are new licensees, so as a "been-there, done-that" ham of over 50 years, I'm hoping that you'll have as much fun with your new hobby as I have had, and maybe it'll have as much of an influence on your life as it has had on mine. You could do worse. Probably will.

Back when I got hooked on the hobby, 80% of the newcomers were teenagers (like me), and 80% of them went on to high-tech careers (like me). Back then we were called "radio fiends." Back then amateur radio was the main source in America of electronic scientists, engineers, and technicians.

So here we are entering 1995 and here you are with your ham ticket. The main reason I started *Radio Fun* was to help newcomers find out how many exciting things there are to do in our hobby. Well, it's a whole bunch of hobbies, really. A whole bunch of ways to have fun and adventure. And the more fun you have, the more you'll learn about radio, electronics, and communications.

Today we're entering a communications age that would have been beyond the imagination of most science fiction writers 50 years ago. The information superhighway is opening and you've got your ticket . . . if you use it. It's starting with the landline networks like Internet, CompuServe, Prodigy, and so on. But we're adding video, interactivity, paging, message storage, and bulletin boards . . . and soon these will be tied in with amateur radio.

There's tons more to learn today compared with the primitive radio world I entered in 1936 when I built my first radio. That radio was a turning point in my life. I'd been given a box of radio parts by a passing angel (it happened in church!). I found a circuit in *Popular Mechanics* that used these parts for a cigar-box radio. When it worked I was hooked. I bought more parts, built more radios and amplifiers. I started listening to the short waves and joined my high school radio club (W2ANU).

That got me to go to an engineering college. Came WWII and I joined the Navy as an electronic technician, where I got a superb education in electronics and five much-too-exciting war patrols on a submarine. After the War I finished college and went into radio broadcasting as an engineer, then into television, first as an engineer, then as a cameraman, and finally a director. All that as a result of a cardboard box of old radio parts.

So what are you going to do in amateur radio? Are you going to go on 2m, talking through a couple of local repeaters, and that's the end of it? Two meters has an amazing array of fun for you, if you'll give it a chance. Have you ever made aurora skip contacts? I guarantee you'll get about as excited as you ever have in your life when you start making aurora contacts. That's fun! And you can do it on CW or sideband!

What else is there on two? How about sideband? And, if your shack is in a lousy VHF location, as almost all are, then you'll be thinking about setting up a remote base, so you can make your contacts from a nearby mountaintop, or skyscraper. If you go that route I'll be after you to use 10 GHz for the control and intercom link. What a range you can have on sideband from up there!

Of course, once you set something like that up you may want to open it up so others can use it too, and you've got your own repeater. John Williams W2BFD and I set up our first repeater back in 1949 on top of the Municipal Building in downtown Manhattan. That made it so RTTY hams throughout greater New York City, New Jersey, Pennsylvania, and Connecticut could all be in contact. RTTY? That's radio teletype. And that's another bunch of fun you can have on two. RTTY is still perking along, as is packet radio, satellite communications, moonbounce, meteor bounce, and so on.

Yep, I'm going to try hard to get you to get involved with our ham satellites so you can start working some real DX. What a blast making contacts all around Europe and South America! Now you can work anywhere in the world via satellites. Doing all this is going to get you interested in learning more. It's fun and exciting to learn.

Or you may get involved with 2m foxhunting . . . building your own receiver and directional antennas that you can carry around hunting hidden transmitters. Then maybe you'll get your local ham club all involved, complete with making videos showing how much fun it is. You do the videos and I'll help you get copies to other ham clubs to get them hooked on foxhunting.

I used to have a ball taking my 2m stuff to the top of mountains and seeing how many contacts I could make. It was like my own contest. I tied a 16-element beam to the top of my car and set up on mountains all around New England. Eventually I set up my own 2m station high up on Mt. Monadnock in New Hampshire, with a kilowatt and a 336-element beam. Lordy, I had a signal! Well, I said that amateur radio had hooked me.

The *Radio Fun* Purpose . . .

. . . is to get you hooked on more and more

Continued on page 7

Resistance

by Larry R. Luchi W7KZE

Although it might seem that resistance has a disadvantage in reducing the current in a circuit, resistors are probably the most common components in electronic equipment. A resistor is manufactured with a specific value of ohms for its resistance, "R." The construction used most often is the carbon-composition type. The wire-wound type is larger for higher power ratings.

The purpose of using a resistor in a circuit is either to reduce the current, "I," to a specific value or to provide a desired voltage "V." For an example, a series resistor in the output circuit of a transistor amplifier accomplishes both of these functions. First, the resistor R can limit I to the current rating of the transistor. Furthermore, the external voltage V provides a sample of the internal transistor current. Then the amplified voltage across R is available to be connected to the next circuit. Another feature of resistance is that the effect is the same for DC and AC circuits.

Types of Resistors

The two main characteristics of a resistor are its resistance, R, in ohms and its power rating, "W," in watts. Resistors are available in a very wide range of R values, from a fraction of an ohm to many megohms. Power rating may be as high as several hundred watts or as low as 1/10 W.

The R is the resistance value required to provide the desired current I, or voltage. Also important is the wattage rating, because it specifies the maximum power the resistor can dissipate without excessive heat. Dissipation means that the power is wasted, since the resultant heat is not used. Too much heat can make the resistor burn. The wattage rating of the resistor is generally more than the actual power dissipation, as a safety factor.

Wire-Wound Resistors

In this construction, a special type of wire called resistance wire is wrapped around an insulating core. The length of wire and its specific resistivity determine the R of the resistor. Types of resistance wire include tungsten and manganin. The insulated core is commonly porcelain, cement, or just plain pressed paper. Bare wire is used, but the entire unit is generally encased in an insulating material.

Since they are generally for high-current applications with low resistance and appreciable power, wire-wound resistors are available in wattage ratings from 5W up to 100W or more. The resistance can be from less than 1 ohm up to several thousand ohms.

Carbon-Composition Resistors

This type of resistor is made of finely-divided carbon or graphite mixed with a powdered insulating material as a binder, in the proportions needed for the desired R value. The resistor element is enclosed in a plastic case for insulation and mechanical strength. Joined to the two ends of the carbon resistance element are metal caps with leads of tinned copper wire for soldering connections into a circuit. These are called axial leads because they come straight out from the ends.

Film-Type Resistors

There are two kinds of film-type resistors. This carbon-film type has a thin coating around an insulator. Metal-film resistors have a spiral around a ceramic substrate. Their advantage is more precise R values. The film-type resistors use metal end caps for the terminal leads, which makes the ends a little higher than the body.

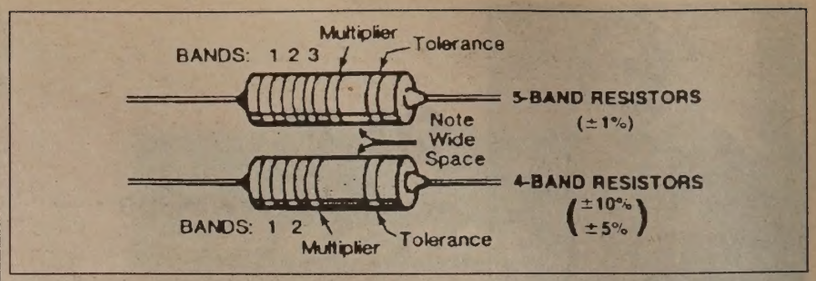


Figure 1.

Resistors' Color Code

Resistors are identified in parts lists and steps by their resistance value in ohms, kilohms, or megohms. They are usually identified by a color code of four or five color bands, where each color represents a number. See the Resistor Color Code chart in Table 1. These colors are given in the steps in their proper order (except for the last band, which indicates a resistor's "tolerance"; see the Resistor Tolerance Chart, Table 1). You do not need to memorize the color code.

Occasionally, a "precision" or "power" resistor may have the value stamped on it. The letter R, K, or M may also be used at times to signify a decimal point, as in:

2R2 = 2.2 ohms
2K2 = 2.2 kilohms, or 2200 ohms
2M2 = 2.2 megohms

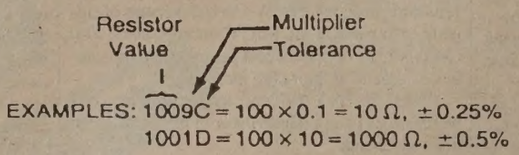
Precision resistors may also be marked as shown in the following examples. The values of the multipliers are shown in the Multiplier Chart, and the tolerance values are shown in the Resistor Tolerance chart, both in Table 1.

When we have a circuit with voltage V applied and resistance R in the closed path, it is important to know how much the current I is in the circuit. This article explains how the amount of I increases with more applied voltage but less with more resistance. Specifically, I = V/R as determined in 1828 by the experiments of Georg Simon Ohm. If we know any two of the factors R, I, and V, the third can be calculated.

Ohm's Law is also used to find out the amount of electric power P in the circuit. The P can be calculated as V x I or I^2 x R. All these relations derived from Ohm's Law apply to both DC and AC circuits.

The symbol for potential difference is V for voltage. In fact, the volt unit is used so often that potential difference is often called voltage. Sometimes the symbol E is used for Elec-

Continued on page 6



RESISTOR COLOR CODE CHART

	Band 1	Band 2	Band 3 (if used)	Multiplier
Color	1st Digit	2nd Digit	3rd Digit	Multiplier
Black	0	0	0	1
Brown	1	1	1	10
Red	2	2	2	100
Orange	3	3	3	1,000
Yellow	4	4	4	10,000
Green	5	5	5	100,000
Blue	6	6	6	1,000,000
Violet	7	7	7	10,000,000
Gray	8	8	8	100,000,000
White	9	9	9	1,000,000,000
Gold	-	-	-	0.1
Silver	-	-	-	0.01
No color	-	-		

RESISTOR TOLERANCE CHART

	COLOR OR LETTER	
± 10 %	SILVER	
± 5%	GOLD	J
± 2%	RED	G
± 1%	BROWN	F
± 0.5%	GREEN	D
± 0.25%	BLUE	C
± 0.1%	VIOLET	B
± 0.05%	GRAY	

MULTIPLIER CHART

FOR THE NUMBER:	MULTIPLY BY:	FOR THE NUMBER:	MULTIPLY BY:
0	1	4	10,000
1	10	5	100,000
2	100	8	0.01
3	1000	9	0.1

Table 1.

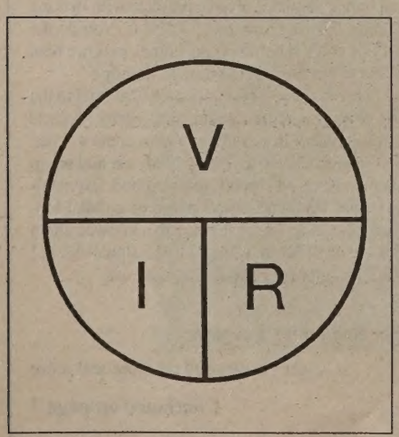


Figure 2.

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letters

Write to: Radio Fun Letters
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John Szwarc, Philipsburg PA Wayne, if you've been involved in amateur radio for what seems like a lifetime, your memories of the difficulties involved in getting started have probably faded. Sure, you don't have to learn the code anymore, but it's still a challenge! Everyone has a different theory on how to study for the test and what equipment is best. And there's the waiting. It seems like a lifetime before your ticket finally arrives in the mailbox.

As a prospective ham, I became involved with my local radio club. Well, OK—it's more of a loosely knit informal social gathering once a month. No agenda engraved in stone and no subcommittees to report back back to the club. It's a real "hands-on" experience for a new ham as we discuss the particulars of installing the planned 2 meter repeater!

When you're well-prepared, taking the written test isn't all that difficult. After weeks of studying, I passed on the first try!

Now it's time to start planning that first shack. After spending several days studying the ham magazines and requesting information on equipment, yet another snag. If you don't have a call, many of the suppliers won't send a catalog or sell you anything! When my ticket finally arrives I still wouldn't have a shack if it were left to these suppliers. Fortunately, some fellow hams had a good supply of catalogs and spare equipment to get me started.

John, no I haven't forgotten what it was like when I got started. I remember the first two times I failed the code test. Scared. I remember my first contact. It was on 2-1/2 meters with a walkie-talkie I'd built.

If they ask for a call to get a catalog, you can make one up that's too new to be in the Callbook. *They can't check it. They're idiots. But I suppose they want to watch out for truck drivers trying to buy 10m rigs.*

David, callsign and address withheld Every day I see some new, improved product coming down the pike for ham radio or scanning enthusiasts, but I still have not seen anything to fill a gap I see forming. There are many of us out there who enjoy listening to public safety communications, but are slowly being prevented by the technology being used.

Most agencies use CTCSS (Motorola's PL) but there are more and more agencies going to Digital Squelch (DPL), and I have yet to see any scanner or amateur receiver that can decode DPL. The growth of Trunked 800, and the 900 MHz system, is only adding to the problem. In larger systems, it would be almost impossible to listen to only the channel that we are interested in. Cleveland, Ohio, is a prime example. They will soon be going to a trunked system, and so far are licensed for 50 channel pairs, for all public safety (possibly even all city services)—picking out only the police department's second district would be impossible.

Every day, computers get more and more sophisticated. It would seem that with a little work, someone could come up with a scanner or receiver that is capable of reading and decoding the signals coming from the trunked radios, and allow for only that radio's transmissions to be heard. Trunked systems are little more than a computer-controlled radio, so why can't we get something like that to monitor the systems?

I know there are those out there who will try to say that we have no right to listen in on the police, and we should not try to invent the technology to make it happen. But, as a police officer myself, I can say beyond a doubt: Most of the radio traffic is not so sensitive that others should be prevented from hearing it. There are times when the public should not hear certain parts of the traffic, but there are many scramblers on the market on VHF, and they work well. Like many departments, we are changing to an 800 trunked system, but we will no longer have scramblers (too expensive, they say).

It would seem that with all the computer experts out there, someone must be able to come up with a computer-controlled receiver that would allow us to listen to trunked and DPL transmissions. RF

Resistance

Continued from page 4

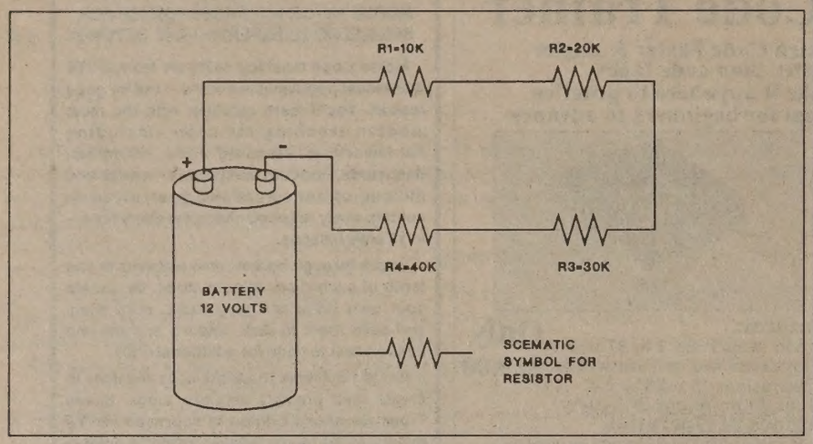


Figure 3. A series connected circuit.

tromotive force (EMF), but the standard symbol is V for any potential difference. Amateur radio still uses the symbol E for voltage, this is the exception, not the rule.

Ohm's Law

Georg Simon Ohm, a German physicist (1789-1854), in a primitive lab came to the natural conclusion that a unit of electrical resistance, equal to the resistance of a circuit in which an electromotive force of 1 volt, maintains a current of 1 ampere.

Ohm's Law relates the voltage (V), the total current (I), and the total resistance (R) in an electrical circuit. Voltage is measured in volts, current in amperes, and resistance in ohms. Ohm's Law is fundamental to the study of electrical circuits.

For the current, Ohm's Law can be written as: I = V/R (Equation 1).

If we keep the same resistance in a circuit but vary the voltage, the current will vary. This can be demonstrated with a light bulb that has a 12V filament.

With 12 volts applied, the bulb lights, indicating normal current. When V is reduced to 10 volts, there is less light because of less I. As V decreases, the bulb becomes dimmer. For zero volts applied there is no current and the bulb cannot light. In summary, the changing brilliance of the bulb shows that current is varying with the changes in applied voltage.

For the general case of any V and R, Ohm's Law is: I = V/R.

The Voltage (V = I x R)

This is Equation 2. The voltage across R must be the same as the V because the resistance is connected directly across the 12V battery. The numerical value of this V is equal to the product I x R.

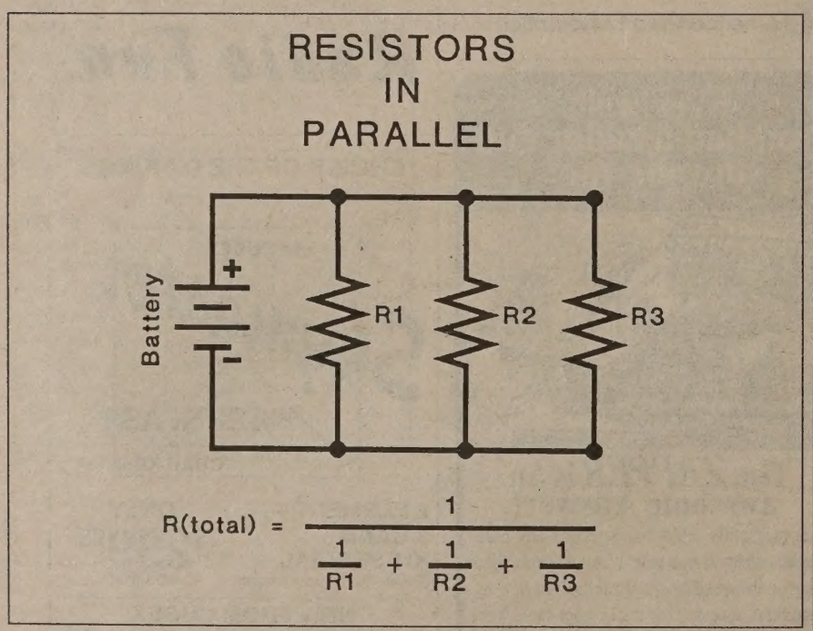


Figure 4. The Reciprocal Formula as used in calclations.

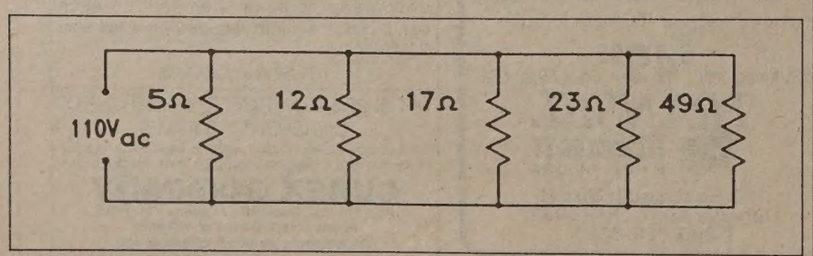


Figure 5. Parallel circuit.

The Resistance (R = V/I)

As the third and final version of Ohm's Law, the three factors V, I, and R are related by the formula: R = V/I (Equation 3).

Series Circuits

If two or more components are used with the voltage source, different types of circuits are possible. When the components are connected with only one path for current through all of them, the result is a series circuit. The series path is made by connecting an end of each component to an end of the next. Which end comes first does not matter with resistors. Since there is only one path for electron flow, the current, I, must be the same in all the series components.

The purpose of a series circuit is to connect different components that need the same current. However, the individual voltages across each of the series components can have different values. These principles of series connections apply to DC and AC circuits.

Rules of a series circuit: 1) The current is the same throughout the circuit; 2) The source voltage equals the sum of the individual I x R drops; 3) The total resistance is the sum of the individual resistors.

Parallel Circuits

Components in series have one common current, but parallel circuits are used where it is necessary to have one common voltage across all the components. A typical application is for the lights in a house, where they all need the same 110V from the AC power line. As a definition, a parallel circuit is formed when two or more components are connected across one voltage source. The polarity of the connections does not matter for resistors. Each parallel path is then a branch circuit, with its own individual current.

Parallel circuits, therefore, have one common voltage across all the branches but separate branch current that can be different. The principles of parallel or series connections apply to DC and AC circuits.

Using the Reciprocal Resistance Formula; We can derive this formula from the fact I_T is the sum of the branch currents, or:

$$I_T = I_1 + I_2 + I_3 + \ldots \text{etc.}$$

However, I_T is V ÷ R_T. Also each I is V ÷ R. Substituting V ÷ R_T for I_T and the left side of the equation and V ÷ R for each branch I on the right side, the result is:

$$\frac{V}{R_T} = \frac{V}{R_1} + \frac{V}{R_2} + \frac{V}{R_3} + \ldots \text{etc.}$$

You can divide by V because it is the same across all of the parallel resistors.

To solve for the total resistance in a parallel circuit use the Reciprocal Resistance Formula, Equation 4, where:

$$R_{TOTAL} = \frac{1}{\frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} \ldots \text{etc.}}$$

Example 1: Five amateur radio units having resistance of 5, 12, 17, 23 and 49 ohms are plugged into 110-volt outlets. If all the appliances are turned on, what is the total parallel resistance (R^T) and the total current (I^T)?

When using Equation 1 with a calculator, use the [EE] or [EXP] key for the exponents (power of 10), K-ohms equals exponent 3. Your calculator will then default to a positive exponent. The [1/X] key on most calculators is the reciprocal key; some calculators use the [1-1] key for the same function. Practice with the following example:

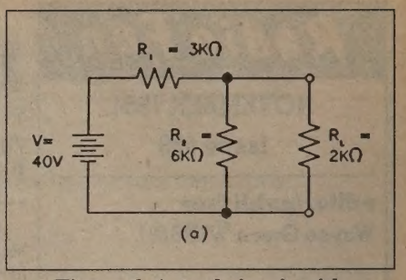


Figure 6. Actual circuit with terminals across R_L.

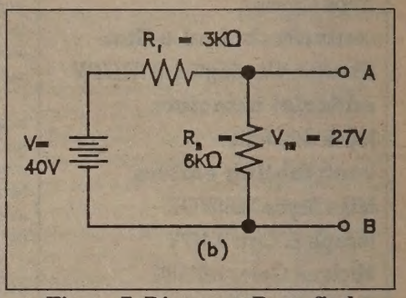


Figure 7. Disconnet R_L to find that V_{TH} is 27V.

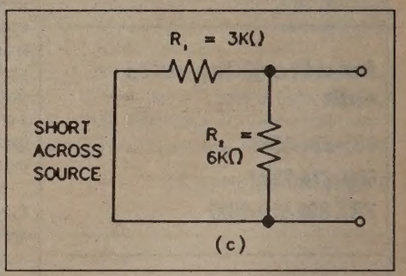


Figure 8. Short-circuit V to find that R_{AB} is 2-KΩ

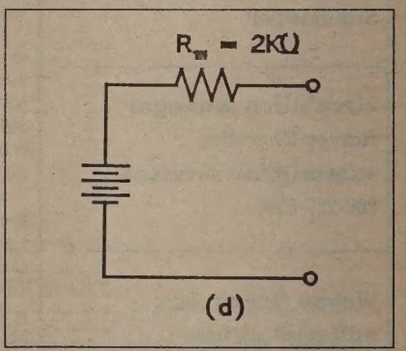


Figure 9. Thevenin equivalent circuit.

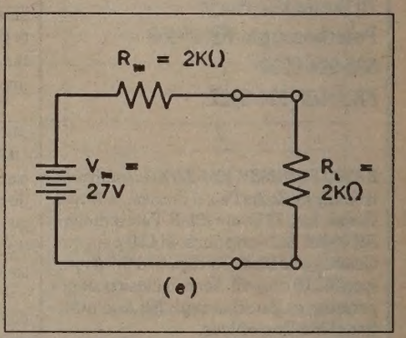


Figure 10. Reconnect R_L at terminals A and B to find that V_L is 27V.

ENTER	DISPLAY
[CE/C]	0.
5 [1/X][+]	0.2
12 [1/X][+]	0.2833333
17 [1/X][+]	0.342156862
23 [1/X][+]	0.385635123
49 [1/X][=]	0.406043286
[1/X]	2.46791609 or 2.5 ohms
[STO]	2.462791609

Continued on page 9

Newcomer

Continued from page 3

fun things you can do in amateur radio. I want to get you excited about RTTY, slow-scan, packet, and all the rest. I want you to have as many adventures as I have. Maybe more, if possible. I've been on some hairy DXpeditions where I came close to getting killed. But they were super fun too.

In the old days I could go down to Courtland Street in New Yok and buy parts to build just about anything. Then, after the War, came surplus. Wow! I filled my cellar and four neighbors' garages with surplus electronic equipment. Tubes? I had hundreds of 'em, from acorn and peanut tubes on up to huge transmitting tubes. You need an 833? No problem.

These days you have to buy kits if you're going to build. With more and more hams finding out how much fun it is to build we're seeing lots of new kits coming available. Every time you buy a kit and build it I expect you to keep notes and let me know what problems you've had, and how much fun. You let me know, and I'll pass along the word to help others.

Once I've hooked you into trying some new aspect of amateur radio through *Radio Fun* I expect you to do your bit to get others hooked. I want articles, letters, and photographs. What I don't want is for you to end up like several thousand old-timers, swapping signal reports and reciting the same old baloney for years. Or just rag-chewing. You have an incredible opportunity for adventure . . . for excitement . . . for fun, and I'm going to do what I can to get you to see how much fun there is to have.

Subscribe

You'll only be getting a couple of sample issues of *Radio Fun,* so I'm hoping you will quickly subscribe and not let your normal procrastination separate us. It only costs $13 to subscribe. Heck, make that $25 for two years so I won't have to waste postage getting you to renew next year. You'll then be getting a monthly shot of excitement and encouragement to try new bands, new modes, and new fun. You don't want to miss my story of operating from YK1AA's shack in Damascus, do you? Or from Katmandu and 9N1MM?

And while you're at it, I also want you to subscribe to *73.* The downside is that my editorials are longer. The upside is that it's a bigger magazine and packed with reviews of new equipment (more than any other ham magazine by far), and lots of articles that will help you learn more about slow-scan, packet, antennas, and so on. *73* is *the* magazine for active hams. It's only $20 a year. I started it back in 1960 and for some reason it's still going. So here I am, a living link with the past. But I'm also, as I said, a been-there, done-that editor.

I've worked seven states on 10 GHz. I've represented America at the ITU in Geneva. I've been on two around the world DXpeditions. Oh heck, you don't want to read about all my stuff, what you want to do is get busy and start having your own adventures. You can read about mine in *Radio Fun* and *73.* And, if I can ever get you to write and take some pictures, maybe I'll be printing your stories of DXpeditions, getting new hams licensed, and adventures on our satellites. Maybe you'll send me some DX color photos you've gotten via slow-scan. Or lists of the DX you've worked on 160m and 80m. Or perhaps I'll work you when you're visiting 3D6 or 7P8. Yep, I'll tell you I been-there, done-that.

Subscribe for a Friend

Is there someone you know who's interested in hamming? You could do worse than get their juices going with a gift subscription to *Radio Fun.* For $25 you can sign up two friends and give them monthly reminders that you are thinking of them. It might get them busy getting their tickets, or getting involved with more adventure, if they are already licensed. That's about what you spend going to the movies, right? Or for one dinner out. You might just turn out to be the angel who turns some youngster's life around by getting him or her involved with amateur radio.

The chap who brought that box of old radio parts into the Dutch Reformed Church in Brooklyn back in 1936 is long gone, but the mischief he caused lives on and you can enjoy the results in my magazines. So polish up your halo and give some gift subscriptions to *Radio Fun.* Give yourself one too. RF

The Mistakes New DXers Make, Part 2

Learning the ropes of long distance hamming.

by Steve Katz WB2WIK/6

Last month, in Part 1, we introduced you to the world of DX by first pointing out some of the awful operating practices that newcomers sometimes use. We defined what we mean by *real* DX, and we discussed DX nets, packet cluster nets, and QRP etiquette. Let's move on now to split operation.

Split Operation

Many DX stations operate "split," that is, they transmit and receive on two different frequencies. Don't hate them for it. They do it to make it easier on those of us trying to work them—we'll be able to hear them while others are still calling because the pile-up is on one frequency, while the DX station is on another. The technique works well if the DX station can control the pile-up so that callers don't occupy the whole darned band.

The best technique a DX station can use is to announce the upper and lower frequency limits of his receive tuning range, and not answer anyone outside those limits. For example, FOØCI (Clipperton) might say, "CQ DX 185 to 200" on 20 meters. This means he's listening on 14.185 to 14.200 MHz. He might be transmitting on 14.152; it doesn't matter. He's announced where he's listening, and that's all that counts. If the DX operator is smart, he won't even bother listening on his own frequency or even 100 Hz outside the announced limits. If you call him, be sure you're within the limits he's announced. If you're not licensed to transmit where he's listening, forget it for the time being and look for somebody else to work.

Actually, one of the *best* times to work DX is when a rare DXpedition is on the air! For at least the first few days of such an operation, practically the whole world is calling the new "rare one," leaving the rest of the band wide open for whoever isn't involved. I've worked some of my best DX just up or just down the band from "rare DX" pileups, by ignoring the "rare one" and looking around for somebody else.

If your particular rig cannot work split, you can still be involved in split operations, but it's more work (or fun, depending on how you look at it!). One easy way to work split without having a modern transceiver which has this function is to have a second receiver. Used receivers which work fine on the ham bands can be found for less than $100 at many swap meets. Use the spare receiver as your main receiver, and use your transceiver as a transmitter only. This will mean you'll need either two antennas (one for transmitting, one for receiving), or an antenna relay to switch your single antenna back and forth between the two pieces of equipment. It's really no big deal. Also, a lot of older rigs, even those dating back to the 1960s, had available "external VFOs" which allowed them to operate split when connected to an accessory socket. But sometimes the "external/remote VFO," even secondhand, can cost more than a spare receiver. Faced with the choice, I'd go for the second receiver—it's a more versatile tool.

More Tips

Many newcomers draw the incorrect conclusion that a big, powerful amplifier is a real asset to working DX. NOT! If I had to list the most important ingredients to DX work in order of priority, they'd be:

1. Operating technique
2. A good antenna
3. A good receiver
4. Flexible operating hours (actually, maybe this should be #2!)
5. Transmitted signal quality (modulation, keying characteristics, "cleanliness"of signal)
6. Transmitter power (the higher, the better!)

You might notice that the "big amplifier" places down there at the bottom of the list. Operating technique, antenna, receiver, and flexible operating hours are all important factors, and all surely more important than transmitter power. I'd trade being able to always operate at sunrise and sunset with 50 watts for having a 1500 watt amplifier any day of the year. And I'd also surely rather have nearly 30 years experience at working DX (which I do) than that big amplifier. Same goes for signal clarity. It doesn't help to have a distorted 1500 watt signal when a "clean" 50 watt signal will get through better every time.

When all the other bases are covered, the big amplifier will help you make more DX contacts with ease. But remember that 1500 watts is only 11.76 dB (about two "S" units) more powerful than 100 watts. There's much more than 11.76 dB difference between various antennas. The station with the 5 element monoband beam on a 70-foot tower has much more than an 11.76 dB advantage over the station with a dipole at 30 feet or a vertical in his backyard. That's not to say that a low dipole or vertical cannot work DX—sure it can, but it might take a bit more talent than using the big beam on a high tower. Most of the best operators in the world started out as "little pistols," not big guns, and developed their expertise by successfully DXing with very modest stations.

Since we've touched on antennas, let me add a brief word for the uninitiated: If you don't have a big tower and beam, and most newcomers don't, remember that some of the basic laws of antennas dictate that a vertically-polarized antenna will generally radiate (and receive) a lower-angle signal than an antenna that's horizontally-polarized. Lower-angle radiation means reflecting your signal off a more distant point in the ionosphere, making for greater (longer distance) DX. As such, a good vertical antenna will be superior to a typical dipole for DX work. But I said a "good" vertical antenna. If you want to work DX on several bands and have limited space or a limited budget (or both), try a *good* vertical. This would be something like an R-7, DX-88, HF6V, etc., elevated as high as possible above your property and installed over an adequate counterpoise (ground plane system), or a GAP Challenger ground-mounted and installed *in the clear* of local obstructions. But beware that a really *good* vertical is not a great antenna for local work and tends to have too low a radiation pattern for "short skip." If you have a limited budget and want to work both DX and close-by stations, it is helpful to have a well-installed vertical for the long-haul DX, supplemented by dipoles for the closer stuff. Read antenna books and make a habit of reading Joe Carr's column for more info on this.

Bands and Countries

For the Novice and Tech-Plus hams, the only place to work voice DX is 28.300-28.500 MHz (or, for Techs, occasionally on 50 MHz when conditions are right). But everyone who has passed a code test has CW privileges on three more great DX bands: 3.7, 7.1 and 21.1 MHz. With the decline in solar activity that will place us in the "DX doldrums" for the next few years on the bands above 14 MHz, both 40 and 80 meter CW will be "where it's at" for some interesting DXing through the year 1997 or so. Most of the best (rarest) DX hangs out at the low end of each band, in or near the Extra-Class CW subbands; however, there *is* DX to be worked in the novice CW subbands, too. The recent Clipperton Island DXpedition, FOØCI, was worked by a good number of Novice/Tech-Plus operators; I heard FOØCI calling CQ in the Novice bands myself. Many other expeditions to "rare ones" eventually get to the Novice subbands as well—maybe not during the first few days of the operation, but after the "main" operation calms down and they've worked most of the world, even the DXpedition groups start searching around for new contacts.

The International Telecommunications Union (ITU) stations, like 4U1UN in New York City and 4U1ITU in Geneva, Switzerland, spend a lot of time in the Novice bands and count as new countries, apart from the countries in which they are located.

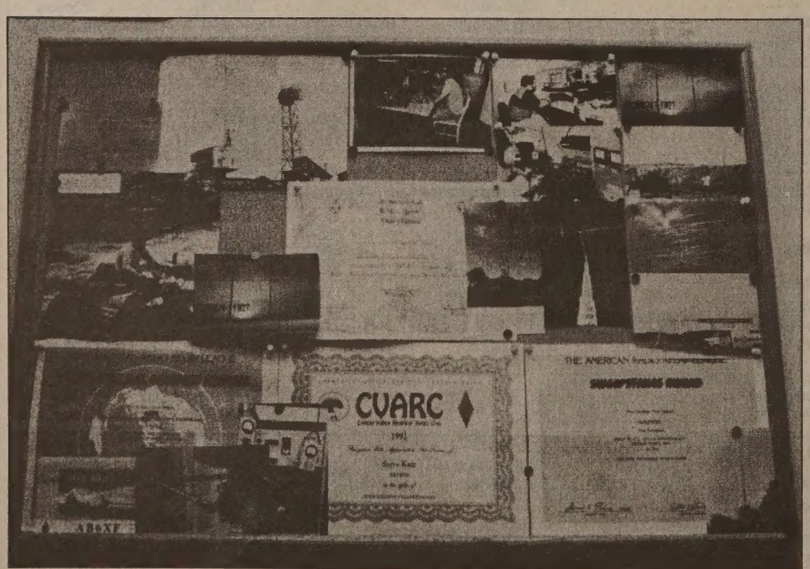


Photo A. Everyone should have a "momento" display, a place for memorable photos, awards, or whatever.

Photo B. The main operating station.

Remember that even KL7 (Alaska) and KH6 (Hawaii) count as DXCC countries, a throwback to the time before they became states. Besides KL7 and KH6, which count as both states and countries, other U.S. territories, many of which are quite close by, have Novice Class licensees who populate the bands. Puerto Rico, the U.S. Virgin Islands, Guam, Midway, etc. are examples. United States territories contain 21 separate DXCC countries: The U.S.A. ("lower 48") and 20 others. Your DXCC total could potentially be 21 before you work a foreign country! French territories total 18 different DXCC countries: France, plus 17 others. British territories total another 14; Russian republics comprise another 14.

When you upgrade to General Class, you'll have available to you the *premier* DX band for the mid-1990s: 30 meters. This digital-mode only band (CW + advanced digital modes allowed, no voice), while only 50 kHz wide, is the hangout for the world's juiciest DX and is often "wide open" when 20 meters is closed down tight (no worldwide propagation) and 40 meters is too full of QRM to work anybody. Not only is 30 meters in a prime part of the radio spectrum for worldwide propagation about half of each day (check conditions by tuning into WWV on 10.000 MHz and watching for changes in its signal strength), but it is the "poor man's" DX band because it is the only band in the MF-HF-VHF spectrum with a full-time power limit for all classes of licensee. No 1500 watt amps to compete with on this band! And not many users have beams for 30 meters, either (although some do). If you put 100 watts into an efficient vertical antenna, you'll be about equal with 90% of the stations on the band.

QSLs

While DX contacts may be fun, receiving QSL cards confirming those contacts adds a new level to your enjoyment and will allow you to qualify for awards (DXCC, WAZ, etc.) mentioned earlier. How do you get DX contacts to confirm (QSL) your contacts with them? You can use any of these approaches:

1. Batch your outgoing QSL cards together and send them out to the DX "via the bureau." This is the least expensive approach to QSLing and works quite well, with a couple of "caveats": First, you must be a member of the ARRL to use our outgoing QSL bureau. If you're not already a member, this will cost you $30 annually for membership. The outgoing bureau doesn't work for nonmembers. Second, this is a *slow* approach to QSLing. It is possible there will be a three- to six-month delay before the DX station even receives your card, let alone sends you one back. Also, some DX countries cannot be accessed by the ARRL's outgoing QSL bureau.

2. Batch your outgoing QSL cards together and send them to the DX bureaus yourself, bypassing the League's outgoing QSL service. This way, no ARRL membership is required and the DX station will get your card somewhat faster. But this will cost you more in postage, since you're mailing directly to foreign countries. If you use airmail for the fastest possible service, even one QSL card in an envelope will cost you $0.50, as foreign airmail service from the U.S. Post Office costs $0.50 per *half-ounce* (not full ounce). Still, some DX countries have no incoming QSL bureau, so this won't work for everybody.

3. Send your DX QSL cards directly to the DX stations worked, one by one. This is the most expensive way, but it shortcuts the other systems and helps assure a more speedy reply. When sending a card to a DX station, you'll need to use two envelopes: an outer envelope containing your properly completed QSL card *and* another envelope (folded up is OK) which is "self-addressed" (already addressed to yourself), but not stamped with U.S. postage, since U.S. postage doesn't work anywhere except in states and U.S. territories. In addition, the outer envelope would normally contain some form of postage payment from you to the DX station, to relieve his burden of postage costs. This could be two IRCs (International Reply Coupons, available from your local Post Office) or a U.S. dollar bill or two. Assuming you send a single QSL card by airmail this way, your cost of receiving back a single QSL card from that DX station will be about three dollars! But this method has the highest likelihood of receiving a prompt reply. Note: If you QSL a DX station directly, be sure you know his proper "QSL route," or you might be wasting all that money. Many DX stations, especially very active, popular ones or DX-pedition groups, use "QSL Managers" located elsewhere, not at their home station addresses. If your DX contact has a "stateside" manager (based in the U.S.), you're very lucky, as this will cost you less. When QSLing a DX station via a stateside manager, you can use an SASE (self-addressed, stamped envelope) with U.S. return postage on it and maybe do the QSL thing for only $0.58 total ($0.29 on the SASE and $0.29 to mail the outer envelope). If you QSL a DX station via a stateside manager and he is an ordinary DXer, you usually don't need to include any money. However, if you QSL a "DXpedition" via a stateside manager, it is wise to include a dollar or two, not for postage, but to help the group pay for their expedition expenses. If you don't do this, your reply QSL will usually come back "via the bureau," and not directly to you.

4. Always be sure to have some money and/or postpaid envelopes (whichever your local-area incoming bureau prefers) on file with your authorized Incoming QSL Bureau, which has absolutely nothing to do with the outgoing bureau. (Confusing, huh?) The outgoing bureau, as discussed in #1 above, is the ARRL in Newington, CT. The incoming bureaus are independent and located in each call area (some call areas might have *two*—find out which one is the right one for your callsign prefix). Their names and addresses are listed in each edition of the *Radio Amateur Callbook*. I usually send my bureau about $10 or $20, along with my correct mailing address, and they forward incoming DX cards to me until all the money is used up, then they ask for more. Don't worry about them using your money for beer and parties—the bureaus are honest and well-run. They handle thousands of QSLs each month and lose very few. But if you don't have your current address and some money on file with your bureau, you'll never receive any cards this way. Oh, yes, one last note: Your "local" bureau is based on your callsign prefix, regardless of where you actually live. If you live in a call area other than the one where your license was issued, you must use the bureau for the numeric digit in your callsign. For example, my incoming DX bureau is the W2 Call Area QSL Bureau in New Jersey, even though I've lived in California for six years. I still have a "2" in my callsign, and that's all that counts.

Don't hate the DX for wanting us American hams to pay for return postage on QSL cards. Remember, we are the most common amateur operators in the world. Nobody needs another card from the U.S. *They* are the "rare" ones, from whom we desire some service. It is natural to expect that we'll have to pay for that service. However, if you do all your QSLing "via the bureau," both incoming and outgoing, and don't mind the delays encountered this way (it can take six months to a year or more to get a QSL reply via the bureau), many DX stations do QSL 100% "via the bureau" and we don't have to pay them anything to do it.

What to Remember

Getting back to the title of this article: What mistakes do new DXers make? Let's review: New DXers often spend too much time transmitting and not enough time listening; they often use silly phonetics; they sometimes have unclear diction and enunciation making their voices difficult for DX to understand; they tend to work DX first and then find they have no record of how to QSL the contact; they are confused about QSL bureau operations; they frequently have no idea about world geography and who is where; they often jump right on top of a DX station the second he signs his call; they are sometimes confused by "split" operations and don't set up their equipment properly; they often believe that high power is the biggest asset to successful DX work; they tend to ignore propagation vagaries and stick with one band, rather than switching bands constantly to take advantage of conditions; they are often not knowledgeable about nets, DX packetcluster systems and other helpful operations. If you've digested this article, you now know enough about all these things to become a bona fide DXer!

So, if your interest is DX, go for it! Sharpen your operating skills, study the propagation bulletins, do a lot of listening, and then start working the rare ones. It won't take long for you to sound like you've been doing it all your life. RF

Resistance

Continued from page 6

Calculate I = V/R:

117 [+][RCL][=] 47.50706301

The five amateur radio appliances have a total parallel resistance of 2.5 ohms and a total current I of 48.0 amperes.

Thevenin's Theorem

By using Thevenin's theorem, many sources and components, no matter how they are interconnected, can be represented by an equivalent series circuit with respect to any pair of terminals in the network.

Thevenizing a Circuit

As an example, refer to Figure 4, where we want to find the voltage V_L across the 2k R_L and its current I_L.

To use Thevenin's theorem, mentally disconnect R_L. The two open ends then become terminals A and B. Now we find the Thevenin equivalent of the remainder of the circuit that is still connected to A and B.

Our only problem now is to find the value of the open-circuit V_{TH}.

The Thevenin voltage is the voltage that appears across the load terminals when you open the load resistor. Because of this, the Thevenin voltage is sometimes called the open-circuit or open-load voltage. V_{TH} is the symbol for the Thevenin voltage.

Equation 5: $V_{TH} = \frac{R2}{R_1 + R_2}$ x source voltage

This is called the voltage divider formula, where R2 equals 3-K ohms and R2 equals 6k ohms and V1 equals 40 volts.

ENTER	DISPLAY
[CE/C]	0.
[(] 6[EXP] 3[)]	6000.
[+] [(] 6[EXP] 3[+] 3[EXP] 3 [)][=]	0.66666666
[X] 40[=]	26.6666667

V_{TH} = 27 volts

If this calculation is performed without parentheses, the algebraic hierarchy completes the multiplication before the addition. Without parentheses the result is 240080.

The Thevenin resistance is the resistance looking back into the load terminals when all sources have been reduced to zero. This means replacing voltage sources by short circuits and current sources by open circuits, shown in Figure 6.

We can use the Product over Sums formula to solve for Thevenin resistance:

Equation 6:

$R_{TH} = \frac{R1 \times R2}{R1 + R2}$

R1 = 3,000 ohms and R2 = 6,000 ohms

ENTER	DISPLAY
[CE/C]	0.
[(] 3[EXP] 3[X] 6[EXP] 3[)][+]	18000000.
[(] 3[EXP] 3[+] 6[EXP] 3 [)][=]	2000.

The Thevenin resistance is 2,000 ohms.

If this calculation is performed without parentheses, the algebraic hierarchy completes the multiplication before the addition. Without parentheses, the result is 6,000 ohms. Figure 8 illustrates the Thevenin resistance and Figure 9 shows the reconnected Thevenin voltage with the load resistor RL.

Power Dissipation in Resistance

When current flows in a resistance, heat is produced because friction between the moving free electrons and the atoms obstruct the path of electron flow. The heat is evidence that power is used in producing current. This is how a fuse opens, as heat resulting from excessive current melts the metal link in the fuse.

The power is generated by the source of applied voltage and consumed in the resistance in the form of heat. As much power as the resistance dissipates in heat must be supplied by the voltage source; otherwise, it cannot maintain the voltage required to produce the current.

Since power is dissipated in the resistance of a circuit, it is convenient to express the power in terms of resistance R. The formula P = V x I can be rearranged as follows:

Equation 6: Substituting IR for V,

$P = V \times I = IR \times I$

$P = I^2R$

This is a common form for power formula because of the heat produced by current in a resistance.

For another form, subsisted V/R for I. Then:

$P = V \times I = V \times \frac{V}{R}$

$P = \frac{V^2}{R}$

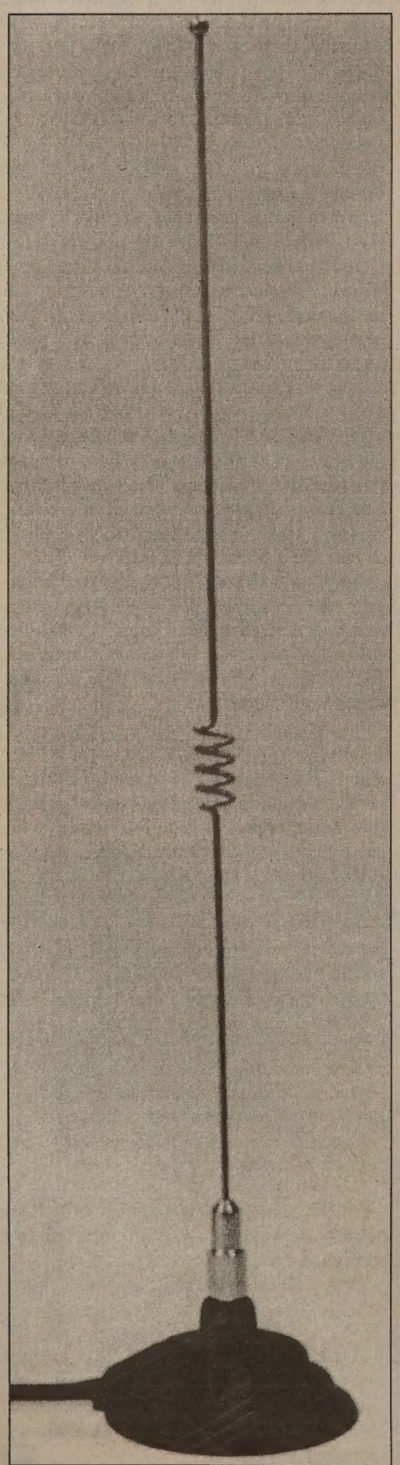
In all formulas, V is the voltage across R in ohms, and producing the current I in amperes, for power P in watts. RF

RF review

MFJ Enterprises, Inc.
P.O. Box 494
Mississippi State MS 39762
Telephone: (800) 647-1800;
Fax: (601) 323-6551
Price Class: $14.95

The MFJ-1724B Dual-Band Mag-Mount Antenna

by Paul M. Danzer N1II



A two-band mag-mount antenna for 15 bucks! As soon as I saw the ad I looked up my favorite 800 number, called, and the new antenna was on its way.

Some years ago the first thing I did with my new minivan was drill a hole in the roof and install a through-the-roof antenna. This time my wife got the new car and she was not too crazy about drilling a hole in the roof of a new minivan with just a few hundred miles on the odometer. Oh well!

The antenna arrived in a 31"-long box which surprised me since the advertised length was 19". The 19" dimension is critical since the latest design trend in indoor parking garages seems to be pipes and beams located at exactly the height of a mini-van plus 20". The twang sound you hear is the antenna hitting a pipe which is only 18" higher rather than the usual 20". However, my fears were quickly removed when the outer box was opened to reveal an in-store display bubble pack with the advertised 19" whip assembly. Actually the total height of the antenna, including the base, is 19-1/4".

The key antenna characteristics are given in the sidebar. MFJ is proud of its quality and provides an unconditional one-year guarantee as well as an 800 number technical support hotline.

Unpacking the antenna consisted of the usual struggle with a very sharp knife and the bubble pack. This is a trade between trying not to cut yourself and not to cut the item in the bubble pack—here it is especially important not to nick the enclosed coax feedline. An Allen wrench is included to tighten the whip into its socket. In addition, MFJ supplies an adapter which can be put on the end of the feedline, converting the antenna plug from a PL-259 to a BNC. Including this adaptor is a particularly thoughtful touch since many mobile rigs use the PL-259 but handie-talkies use BNC connectors.

Will It Stick To the Car?

The first step after unpacking a new antenna is the smoke test: Does it work? I had just placed it on the car when a telephone call came requiring me to take a little ride (about 40 miles or so) on the interstate to pick up a repaired motor. Therefore, the first antenna test was in a heavy rain at highway speed (55 or so). The antenna stayed put on the flat surface of the roof—as it has for many miles since that initial test. What makes this a significant test is that the antenna and base are very lightweight. Measuring its exact weight is difficult without cutting off the feedline, but with the feedline in my hand and the mag mount on a scale it read just slightly over 8 ounces. MFJ claims that it has an "extra powerful magnet." Certainly there is enough power there to remove any worries of it falling off at highway speeds.

SWR on 2 and 440

Comparison of this antenna's SWR with a 19" through-the-roof installed antenna showed very little difference on 2 meters. With the particular SWR bridge used, both antennas show 1.6 to 1 or less across the entire 2 meter band. Feedline loses with the supplied 15' of coax are therefore not a big consideration. A similar test was made against a quarter-wave element for the 440 band. Here the meter used was probably not accurate enough to trust but the two antennas—the quarter-wave 440 MHz vertical and the MFJ unit—were just about the same. This is particularly interesting since the MFJ unit is supposed to give some gain above the simple vertical.

Performance on the Road

The real question with any antenna is "How well does it work?" It would be nice if we could call on a precisely calibrated VHF/UHF antenna testing range and compare the antenna's performance with that of several other antennas, including a standard quarter-wave vertical. Unfortunately, such test ranges are not readily available and simply measuring the antenna with a field-strength meter on the front lawn is a good way to get misleading results. I was very interested in how the antenna worked on the top of the car, as I drove around.

My test was very practical. I drove my car onto the back roads where the local repeater had a fade area. The rig used had a bar graph type of signal strength indicator. I pulled over to the side of the road and jockeyed the car back and forth until the bar graph read less than full strength on the signal strength indicator. Next I switched back and forth between antennas and noted the difference, if any. On 2 meters the result was a peak difference of two units at most—sometimes better on the single-band through-the-roof antenna and sometimes better on the MFJ mag-mount unit. My conclusion was there was no real difference. A few inches in a shadow zone can easily lead to the difference in any one test spot.

On 440 the test was about the same. However, on 440 MFJ calls out a 3 dB gain for the antenna. It is not clear what the reference is for the 3 dB, but if the reference is to a quarter-wave vertical this is a measurable gain.

At these frequencies, using FM, 3 dB is not a very significant number. If your signal is just too noisy to be understood through the repeater 3 dB could make a difference. Except in this very unique case 3 dB will probably not be noticeable if your signal ranges anywhere from somewhat noisy to full quieting ("DFQ—Dead Full Quieting").

Test results against a quarter-wave vertical on 440 were mixed. There were no real differences. But before we jump to the conclusion that the antenna doesn't give a 3 dB gain the test has to be considered. In marginal areas, especially where hills provide shadowing, a gain antenna which produces a lower angle of radiation (see Figure 1) can actually provide a lesser signal strength than an antenna which has a large up coverage. While there is no proof that this is what happened it is one possible explanation.

Pros and Cons

There is no question that this product is a

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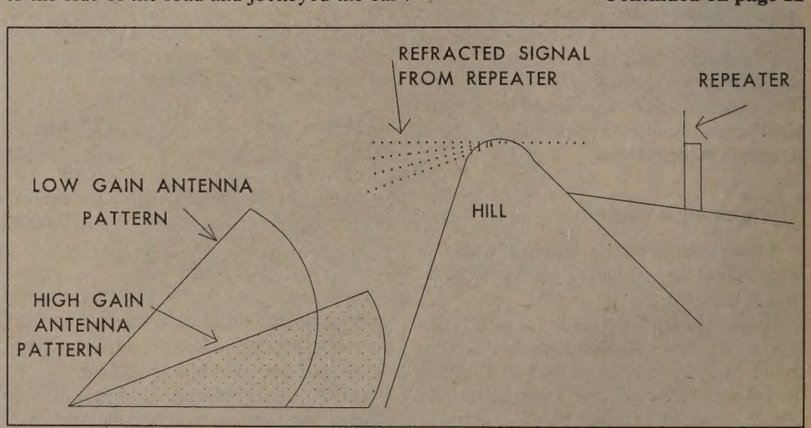

Figure 1. The low gain antenna has a wider vertical beamwidth and captures some of the high-angle refracted signal.

RF review

Standard Amateur Radio Products
P.O. Box 48480
Niles IL 60648
Price Class: $260

The Standard C108A VHF Hand-Held Transceiver

The smallest (for now) HT transceiver has arrived.

by Dave Pelaez AH2AR/5

Question: What weighs a little over four ounces, runs off of two AA batteries, and has continuous receive capabilities from 100 MHz to 174 MHz?

Answer: The latest creation from Standard Amateur Radio Products!

At the Arlington, Texas, HAMCOM last June, a fellow ham showed me a flier from Standard Radio. On the flier was a photo of a curiously-small hand-held 2 meter radio. As I was in the market for a micro HT, this particular design appeared to be exactly what I was looking for. A quick visit to the Ham Station booth proved fruitful—I picked up the last one they had brought to the show.

The Unveiling

After I had taken my newly acquired booty back to my flea market table, a young lad sitting with his father at the adjacent table came over to look at this tiny transceiver. I spent some time paging through the instruction booklet to learn how to operate the many different functions on the HT. The same young lad came over a second time an hour later and said, "You mean you haven't figured it out yet?" I then readily confessed that the HT was far smarter than me!

The perfect excuse for us older-generation types is that there were just too many distractions at HAMCOM to quickly learn a new HT program format. However, one of the very first things I did notice about the HT is that it does not come with a pocket/belt clip, even though the HT is drilled and tapped to accept a belt clip. The deletion of this item from the basic HT seems to be a little unusual. The instructions were clear that this item is not a part of the basic package, and it is carried as an optional accessory.

Features

As different manufacturers have produced their own way of programming an HT, jumping in cold on the keypad usually will cause some frustration . . . ("Dave . . . Why are you yelling at your radio?") *If all else fails, read the instructions.* This HT has seven front-panel buttons, a numbered side volume control, and a rotary frequency selector knob. It has programmable sub-audible tone-frequency capabilities but does not contain a DTMF function, so you will have to use another radio when using the autopatch.

> ***"My initial surprise when listening to QSOs was with the audio quality of the onboard speaker."***

Programming the radio actually ended up being easier than I initially thought. After individually programming 20 repeater frequencies with the CTCSS tones and offsets, the "logic" of the way the radio is programmed begins to become clear. Almost all the functions of the radio are controlled by the VFO/Memory key. Twenty-two separate parameters are set up using this key, and a menu with abbreviated terms can be scrolled by pushing this single button, or by pushing this button and turning the rotary frequency knob simultaneously. The HT also has provisions for a speaker-microphone. Yes, the Radio Shack speaker microphone will work with this HT. The speaker/mike input plugs are close to the antenna, but this does not seem to create any problems.

Power is provided by two AA batteries. Standard used a relatively new high-efficiency DC-to-DC converter (this technology is being seen in more and more consumer products). You can buy regular NiCd AA batteries, just make sure you have the larger size; it requires a special 1.4-volt dual NiCd pack provided by Standard. It then can be recharged with the optional drop-in charger. There is no provision on the HT to use an external power supply.

How long will two AA batteries last? I put some fresh alkaline "AA" batteries in the HT and, for this review, turned *off* the Automatic Power Off (APO) function. For the next 13 days I monitored amateur radio and airband traffic on the same set of batteries. I really was not expecting those batteries to last that long. During this same period I racked up about 15 minutes of transmit time on the HT. With the Auto Power Off function, the Battery Save function, and the basic very low current draw design of the HT using the high efficiency DC-to-DC converter, power drain is just slightly short of being downright amazing.

The only criticism I have is of the battery compartment's plastic cover that slides over the AA batteries. If this diminutive HT is worn on the belt, it will be just a matter of time before the battery cover slides off. I took some Velcro and placed one small piece on the side of one of the batteries and the other on the interior "center track" of the battery cover. If the cover were ever to pop loose, the Velcro would hold the cover on.

The provided "rubber duck" antenna is mounted to the HT with an SMA connector. Due to the radio's very small size, a BNC connector would have been just too big. However, an SMA-to-BNC connector conversion is available at several parts houses in the event you want to use this radio with an extension antenna or in a vehicle.

Performance

In the receiver department, again the best term that comes to mind here is "amazing." My initial surprise when listening to QSOs was with the audio quality of the onboard speaker. Although it's not going to curl the wallpaper with a resounding blast, intelligi-

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The MFJ-1724B

Continued from page 10

winner. You get a lot for $15, including a stainless steel whip with a matching black coating on both the whip and the base. Performance is as good as any other rooftop antenna of comparable height and the one-year guarantee indicates that the manufacturer stands behind the product. One additional word of caution: The antenna looks remarkably like a slightly oversized cellular phone antenna. On the one hand this is good since it doesn't shout out that there is ham gear in the car. On the other hand, it could suggest to a potential thief that there is a cellular phone in the car. I guess you can't win! RF

The MFJ-1724B Dual-Band Mobile Magnetic Mount Antenna

Gain	Same as a quarter wave on 2 meters 3 dB on 440
Height	19" (approximately)
Power Handling Capability	300 watts
Feedline	15 feet long with PL-259 connector, BNC adaptor supplied
Radiator	Stainless steel whip with center coil
Guarantee:	One year—unconditional
Approximate weight	17 ounces with feedline 9 ounces without feedline
Appearance	Black finish, relatively inconspicuous

The Standard C108A

Continued from page 11

bility is superb. In noisy environments, a headset or speaker microphone would be more practical.

Continuous receive coverage from 100 MHz to 174 MHz is obtained with the C108A. Additionally, it has excellent sensitivity and audio quality when listening within the AM aircraft band. A check using an HP station monitor to verify listed receiver sensitivity specs indicated that the provided spec sheet was conservative. The double superhet design of the C108A makes for an extremely sensitive receiver. When compared to two other full-sized HTs manufactured three years back, this little elf has got really big ears.

However, the lack of an LCD "S" meter is somewhat disappointing because if you want to ensure that you have found the best possible "X" prior to operating, it's sometimes difficult to determine whether the optimum position has been found without the help of an S-meter. This is even more critical when you are operating with about one-quarter of a watt.

A check of the transmitter using a 1-watt Bird slug showed close to 250 mW with fresh batteries. Batteries that had been exercised brought the output down to 220 mW. This HT was obviously not designed for breaking moonbounce records. I was looking for three things in a micro HT, and none of them had anything at all to do with the transmitter section. Although audio quality is exceptionally good with the C108A, the radio simply was not designed to be used as a primary HT, without the use of an HT amplifier. To give you an idea of the difference in the 220 mW "footprint," I programmed 20 repeaters in a 3-watt handheld and the C108A. With both radios being used with their provided antennas, of the 20 Metroplex repeaters I programmed, I could hear 12 on the full-sized HT and 14 on the C108A. (Two were marginal on the full-sized HT, but could be heard in the clear on the C108A). I was able to work into seven of the 12 repeaters I could hear with the 3-watt handheld. I could only work one repeater with the C108A. Before you decide whether a low-power micro HT is going to be your primary rig, remember that you will be limited, without the aid of an antenna or amp.

What were the three things I was looking for in a micro HT? I was looking for a very small, convenient HT that would allow long-term receiving capability without having to rely on cumbersome battery packs. I was also looking for an extremely light package for use with portable DFing gear. Lastly, I was looking for a very small "communicator" for hamfests and family outings. The Standard C108A clearly fits well within these three functions. Now if I could only remember where I put it . . . it's so small its easy to lose! RF

Features:
C108A Standard Radio Company 2 meter HT
(70cm version available)

Receiver:
- 100—174 MHz, including AM airband receive
- Squelch—two keypad settings (High or Low)
- Open squelch function
- Reverse offset function
- Band Scan, Channel Scan with "Pause" and "Busy" Scan
- Dual watch capability
- A 20-channel (memory), plus one call and VFO "channel"
- Automatic Power Off capability
- Battery Save Capability
- 2.5 mm speaker jack

Transmitter
- Output: Approximately 230 mW
- 144—147.995 MHz
- Odd repeater split programmable
- CTCSS tone encoder

Power Supply
- 2 AA batteries
- NiCd pack and recharger stand available

RF review

ICOM America, Inc.
2380-116th Ave. N.E.
Bellevue WA 98004
Telephone: (206) 454-7619
Price Class: $440

ICOM IC-2SAT

One of the world's smallest full-featured HTs.

by Michael Geier KB1UM

Can a walkie ever be *too* small? Not as far as this op is concerned. The smaller the better! So I was especially excited to get to try out a little beauty, the new ICOM IC-2SAT.

The operative word here is "wow." The pictures in the ads don't do justice to the compactness of this thing. At first glance, it looks like a toy. It doesn't feel like one, though. The front is firm plastic, and the back is metal and serves as the heat sink for the RF output stage (as with most new rigs). The radio is very solid and, at about 10 ounces (!), it seems hefty for its size. It is somewhat thicker than most small rigs, and has a contoured, sculpted shape, resulting in an unusual, but attractive, appearance. It fits beautifully in your hand. ICOM has paid great attention to the cabinet design, and it shows; the fit and finish are the best I have yet seen in a mini-rig.

After "wow," your next thought may be, "Where's the battery?" Indeed, there is no battery included in the shipping box. This radio has an *internal* battery. Yep, this tiny HT is totally self-contained! It has only a 300 mA-hour capacity, though, so ICOM wisely offers optional batteries, in various voltages and current capacities, which snap on the bottom of the rig in the conventional manner.

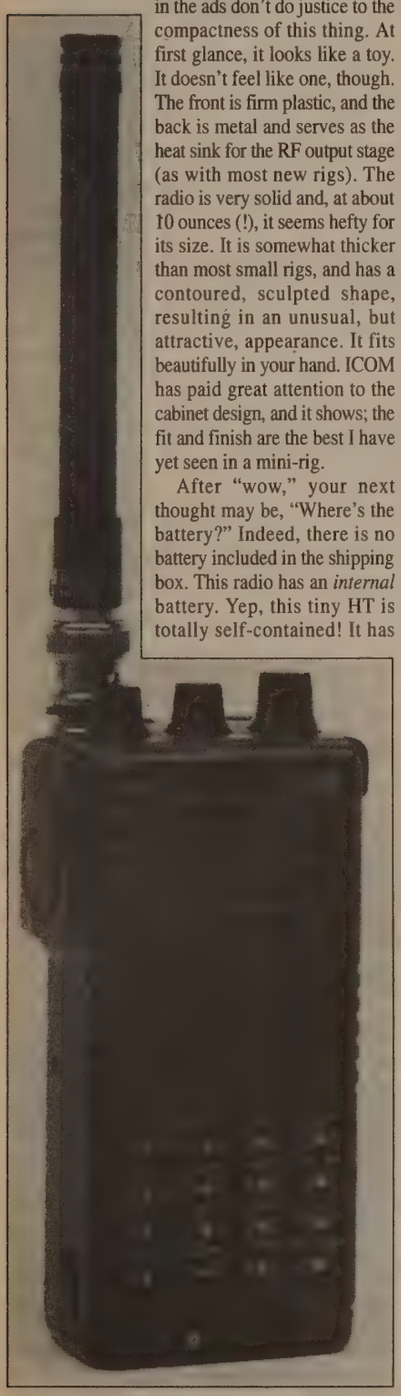


Photo A. The ICOM IC-2SAT, the ultimate in miniaturization.

Good Looking with Nice Touches

The supplied rubber duck is thin, flexible, and somewhat longer than most provided with today's small rigs. In fact, it is slightly longer than the entire radio. No doubt, it has a bit more gain (perhaps less loss is a better description) than the "stubby" ducks usually employed, and that's important here because the rig is rated at only 1-1/2 watts output on high power with the internal battery. The package includes a belt clip (though I can't imagine wanting to put such a small rig anywhere but in a pocket), a wrist strap, wall charger, and a fairly well-written manual with a full schematic. Also included is a crib sheet, a very handy item with a rig this complex. Various options, from the batteries to speaker-mikes and carrying cases, are available.

The top of the radio has the antenna connector, squelch, volume, and "dial" knobs. Also located on top are the DC input, mike, and earphone jacks. The DC jack permits direct operation up to 16 volts (meaning you can plug it into your car cigarette lighter or a DC power supply) and internal battery charging.

On the rig's left side are round, rubberized PTT and FUNCTION buttons, which have an especially nice feel. The LIGHT button, which is also used for a few seldom-performed programming operations, is on the right side. The mike and speaker are located in the middle, with the keypad below them. The keypad has very tiny keys, but they are well separated from each other and easy to press. They are also set in from the front, making accidental keypresses unlikely. It's a nice touch.

Readout Display

The LCD is very large and easy to read, although it loses contrast unless viewed from the bottom. The display shows frequency, + or - offset (called "duplex"), memory channel number, power output selection, S-units, and other assorted operating data. It is a 5-1/2 digit display, with no "0" or "5" at the end of the frequency. To display frequencies ending in a 5, a small "50" appears. Many new rigs are taking this approach, and I do not see the advantage; a fully displayed frequency avoids ambiguity and is easier to read.

For night operation, a press of the LIGHT button illuminates the display with an unusual, deep reddish-orange color generated by two LEDs, one on each side of the LCD. It's very pretty, but not overly bright. It should be adequate in most situations. The lamp circuit has a timer that keeps the display lit for a few seconds after the last keypress, or you can turn it off manually by pressing the LIGHT button again. The keypad buttons do not light up.

Alternate Frequency Entry

Another recent trend has been toward the inclusion of a "dial" knob on top of the rig, and this is a good thing. It began with the Yaesu FT-23R, which did not have direct keypad frequency entry, making the knob essential. Now, even direct-entry rigs like the IC-2SAT have the knobs, and they are very handy, permitting easy selection of memories and CTC-SS tones, as well as an alternate method of frequency entry.

This rig has provisions for CTCSS boards (an encoder or encoder/decoder) and a DTMF decoder. Neither is included. The new DTMF feature permits coded squelch using the tones generated by any rig with a keypad. Thus, you can use it to ignore any station not transmitting your personal code. You can use it with multiple codes, and even display them on the LCD so you know who's calling! This could prove very handy in large cities where repeater overcrowding makes continuous monitoring tedious. To my knowledge, the IC-2SAT is the first handheld to incorporate such a decoder.

Memory Management

The rig has 48 memories which store frequency and offset, including a handy "call" memory accessible with one keypress. They are fix-tuned. That is, they cannot be used like separate VFOs. (The contents of any memory can easily be transferred to the VFO, though.) The first 10 can hold odd offsets, but not independently entered RX and TX frequencies; you must know the offset. The other memories use whatever offset has been programmed into the VFO. The choice of up or down, of course, remains independent.

Memory management, while fairly flexible, is also a bit unusual. There are four banks of 10 memories each. To get to a memory in your current bank, all you need to do is press its number on the keypad. (You must, of course, be in memory mode first.) To get to a memory in another bank, all you need to do is press its number on the keypad. (You must, of course, be in memory mode first.) To get to a memory in another bank, use the dial knob to step through all the memories in between, or press the MR key until the bank appears. Once you have selected the memory bank, enter the last digit from the keypad.

Here's an example: You are at memory 3 and you want to go to 28. Press MR key until the "tens" digit becomes a 2. Then press 8 on the keypad. It's a bit less convenient than simply pressing "28" and then MR, but it's not hard to get used to.

Skipping and Scanning

Memories can be skip-scanned or hidden entirely. They can also be used to make the VFO skip certain frequencies during band scanning, another feature I had never seen before. In fact, the frequencies of memories set for skip-scan will also be skipped during VFO scan. It seems like a good idea, but it doesn't really work too well because the rig stops on adjacent frequencies.

The IC-2SAT has several kinds of scanning, including full-band scan, programmable limited-band scan, memory scan and priority watch. Memories are scanned at about three per second, a bit slow by today's standards. (VFO scanning is significantly faster, but still not zippy.) A twist of the dial knob lets you change scan direction at will. All memories are scanned together, as if in one bank. You can mix modes. For example, you can have the priority watch check a new memory each time it checks, combining memory scan and priority watch in one operation.

In Addition . . .

You can set the automatic power-off feature to shut the rig down after 20, 40 or 60 minutes of inactivity. It warns you with four beeps, and the warning works even if the keypad beeper is shut off. The beeper, by the way, is soft and unobtrusive. It is one of the few made today that I like to keep turned on.

The timer function includes a real-time clock, and you can set it to turn the radio on at a preset time. The battery saver interval can be set for one-half second, two seconds, or off. This seems a bit limited. A choice of around one second would have been nice.

Where most HTs have a *reverse* button, the IC-2SAT has one called MONI. On simplex, it simply opens the squelch. When you're using an offset, however, it shifts to the TX frequency too! It's nice if you want to check the input frequency of a repeater. If, on the other hand, you just want to open the squelch because the repeater's signal is weak, you'll have to use the squelch knob. Also, you cannot transmit on the reversed frequency pair, as you can with a normal *reverse* switch.

The rig has a 10-number by 15-digit autodialer. While sending, it keeps the rig keyed for the duration of the number, even if you let go of the PTT. Also, you hear the tones as they are transmitted. Programming numbers is fairly straightforward, but sending them is not. If you happen to have already selected the autodialler memory you want, then you simply press the DTMF button with the PTT down and the number is sent. If, however, you need a different number, you must first go to DTMF memory mode, select the desired memory, exit that mode, press PTT and then DTMF. This requires five keystrokes, nearly as many as most numbers! This complexity limits the usefulness of the autodialer unless you usually use only one number anyway.

Radio Performance

The receiver, which covers 138-174 MHz, is very good. It is reasonably sensitive and selective, and the sensitivity holds up very well outside the ham band. The received audio sounds surprisingly good for the size of the rig. An experiment with a Kaboom Audio Enhancer (see the Yaesu FT-411 review on page 14 of the June 1989 issue of *73 Amateur Radio*) improved the audio even more, but the enhancer probably isn't necessary with this radio.

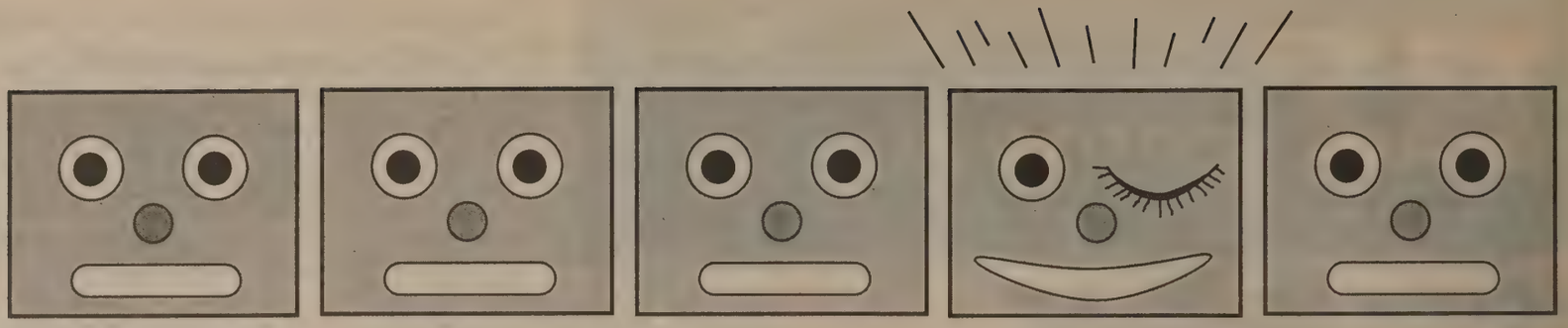
The transmitter, which covers 140-150 MHz, is rated at 1.5 watts output on high power when you are using the internal battery. At 13.8 volts, you get more than 5 watts output. Reports regarding the transmitted audio suggest that it is clear, but a bit tinny and underdeviated. Overall, it was considered quite acceptable, but not great. It may be that the deviation is an adjustable parameter, but I have no way to know.

Nit Picks

This rig has many advanced features, some common ones seem to have been left out. There is no low-battery warning of any kind. When the battery dies, attempts to transmit result in a flashing display, with no RF output. At that point, of course, it's too late.

In addition, there is no auto (ARRL band plan) repeater shift, a common feature on new HTs. Here, you must set the offset memory. Speaking of repeater shifts, offsets are available only in 25 kHz steps. You can't for example, enter in a 610 kHz shift. I'm not aware, however, of any repeaters with offsets that are not a multiple of 25 kHz; all the ones I've used have the standard (600 kHz) or 1 MHz split. Also, the display doesn't indicate the status of the auto power off and battery saver functions. You have

Continued on page 19



How to Purchase the Right Radio

by Stuart Landau K6YAZ

Many times in my 37 years as a ham, I've had the urge to purchase a new piece of radio equipment. As my interests changed, or when I upgraded my license, I felt some urgency to add new equipment, or to replace my gear with the latest and greatest. I would like to share some of my experiences, both as an active amateur, and as a person who repairs amateur radio equipment for a living.

When you start using your new equipment, it's nice to get the most out of it, have it operate for a long time and, if it fails someday, to be able to have it repaired for the minimum cost and in the shortest time. This article may be useful for the beginner as well as the seasoned operator.

Before You Make Your Purchase

Decide what your requirements are, and how much you are willing to spend. If it's possible, try out your choices at a local store or at someone else's station. What looks wonderful in a magazine ad may or may not feel right when you actually have your hands on it. Read the magazine reviews in *73* and *Radio Fun* and talk to others who use that equipment. You are probably going to live with it for many years, so make your decision based on the best information available to you and on your own experience and personal preferences. What might be perfect for someone else might not be right for you.

If you think that you may need help installing the radio and in learning to use it, buying out-of-state rather than from a nearby dealer may be a mistake. You can hardly expect the local dealer to give you free advice and help when you don't purchase from him too.

Keep a copy of the invoice and serial number in a safe place. If required, send in your warranty registration.

If you don't have the money to purchase your rig new, it's worth considering used equipment. When buying used equipment, be cautious. Years ago, dealers had good stocks of used equipment because they took in equipment as trade on new gear. They would go over the equipment before they sold it, and guarantee it. This is rarely done today, and the result is that most used gear is sold by private parties, with only their word backing up your purchase.

If at all possible, carefully look over the equipment before you buy it. How was it treated? If it reeks of tobacco smoke, is dirty or in poor physical shape, be very careful, it may need a lot of cleanup and repair. Get a money-back guarantee if the buyer will agree. Insist on getting the instruction manual. Try it out as soon as possible, or have someone who is qualified check it out. Be cautious of modified equipment. It could cause you a lot of problems. By using your good sense, and with some luck, you may save some money.

When You First Get Your Radio

Carefully unpack and inspect it. Keep all packing materials—you'll need them if you have to ship the radio in the future. Read the instruction manual *before* you attempt to use it! Be careful connecting it up for the first time. If it's DC-operated, reverse polarity or over-voltage (above 16V) are radio killers. Double-check your work. Use the proper fuse.

Taking Care of Your Radio

Keep your radio clean. Cigarette smoke and dirt are hazardous to your radio's health. Cover it when not in use. Keep it dry. Protect the radio from lightning, which can enter through the antenna, AC line, speaker or microphone, and even via your phone patch. If there is any possibility of a storm, disconnect everything—don't take any chances. Also, a nearby transmitter could harm the receiver front end if your radio is connected to an antenna.

Don't modify your radio! During its warranty period this may nullify the warranty. Most modern amateur radio equipment was professionally designed and tested. Many factors are balanced by the designers to make it the best that it can be. Trying to get the last drop of performance out of it often results in poorer overall performance.

"Read the instruction book at the first sign of a problem. Many problems are actually operator error, even if you have used the radio for years."

If You Have a Problem With Your Radio

Read the instruction book at the first sign of a problem. Many problems are actually operator error, even if you have used the radio for years. Try to remember anything that you did just before the problem occurred. Walk away from it for a few minutes. Speak to someone else who uses the same radio. Most major manufacturers have a customer service line and a national service network. If you can't seem to cure the problem, give the line a call. They are very good at solving problems.

When you call, have the radio in front of you if possible, so that you can try things out while talking with them. Describe the circumstances that led up to the difficulty. Information about the band and mode you were operating on, your antenna system, operating temperature, as well as any other useful information you can supply, may be the key to a fast fix. If a fuse has to be replaced, make very sure that it is the proper rating and type. This is your cheapest insurance against expensive repairs. If the proper fuse continues to blow find out why. *Never* use a larger size!

Unless you have repair experience, the service manual, required test equipment, as well as tools and proper replacement parts, don't try to align or repair your radio yourself. In most cases, you will only make things worse. A radio rarely fails because it has drifted out of alignment. This should be the last thing to try. Most of today's radios use microscopic parts and require sophisticated test equipment and tools to make repairs. Tube radios are dangerous to service. High voltage can kill, even if the radio is off!

If you can't solve the problem yourself, send or take your radio to a factory-authorized service organization. They have the expertise to properly repair the radio, unlike the guy down the street who used to repair televisions. When shipping is required, *the box will take a beating*. If you've saved the original packing materials and box, use these. If the shipping carton is old, it may have lost some of its strength. If you have any doubt about how well the container will protect the radio, replace it.

Unless the radio is properly packed, it can break, and all the insurance in the world won't help. A strong box, at least two inches larger than the radio in all dimensions, is needed; this provides "crush space." The radio should rest in foam or plastic chips to absorb the shock of shipping. Anything that sticks out, such as the main tuning knob or plastic feet, often get hit; be especially careful in those areas. Don't include accessories unless you are asked to send them. They could get lost.

Send a written description of the problem with your rig even if you've spoken to someone at the repair company. The person on the phone and the individual doing the repair are probably not the same. The more information that you can give the repair person, the easier it will be for him to repair the problem.

Do you think that something you did may have caused the failure? Tell them. Remember, *time is money;* yours. If they have to phone or write you for additional information, it's on your time.

Are there any additional things that need to be worked on? Be sure to note it. List the same items that you discussed on the phone. Do you think that the antenna or microphone might have contributed to the problem? Has the radio been modified? Include information about any changes that you know have been done.

When the radio is in the warranty period, send a copy of the proof of purchase, or you may have to pay for the work. Has it been seen for the same problem in the past? Try to find a copy of the old repair report, this may be a great help to the service person. How much money are you willing to spend on the repair without being contacted for an estimate? How do you intend to pay for the repair? How can they contact you?

Give the repair facility a reasonable amount of time to complete the repair and to test their work. The service organization should be willing to list what was required to repair the equipment, and if out of warranty, return defective parts. Normally, an alignment and calibration would be a part of the work performed, and they should list exactly what they've done. Remember, some parts for older radios may no longer be available.

If you are unwilling to have all outstanding problems repaired, the repair facility may refuse to work on it. They may require the rig to be brought up to specification in all respects so that they can guarantee their work. Most repair shops are not in the business of equipment restoration. This is a specialty that they may not be able to provide.

In the case of corrosion or lightning damage, the shop may also refuse to work on it because they can't guarantee their work. There may be hidden damage that will cause the equipment to fail again in a short time.

If after you get the repaired radio back you are not happy with their work, contact the repair facility. Most of us take pride in our work, and want to get you back on the air as soon as possible, with a radio that is properly working. RF

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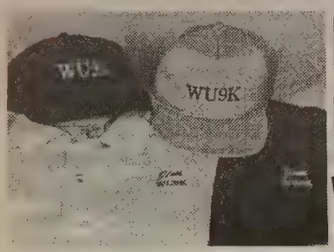

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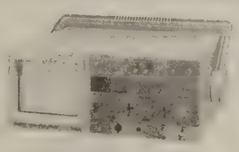

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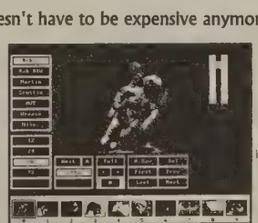

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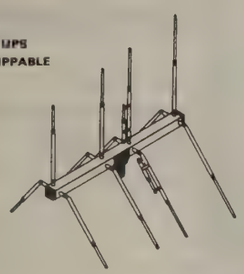

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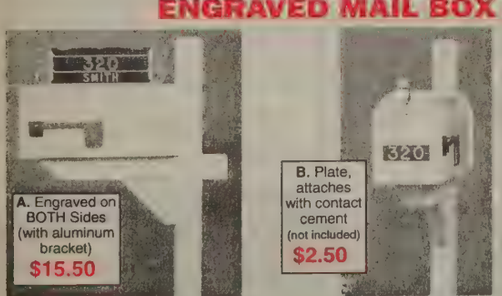

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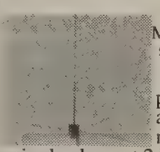

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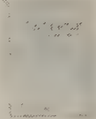

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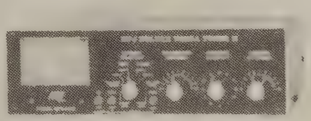

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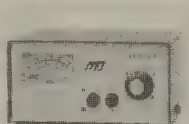

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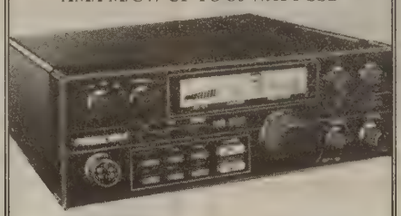

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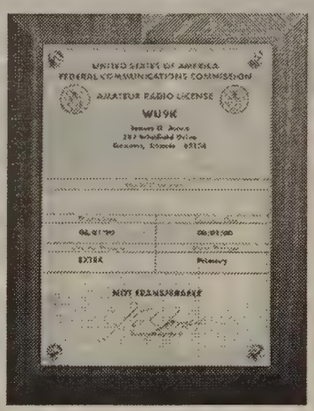

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ICOM IC-2SAT

Continued from page 13

to go to SET mode to find out if they're on or off.

The manual doesn't have any instructions on how to receive outside the ham band. When entering frequencies from the keyboard, only the last four digits are accepted, so getting out of the 14X.XXX band seems impossible. In fact, the rig is already set up for extended coverage, but you can't get to it directly. You must first select the 10 MHz digit with the quick-tuning step function by pressing the function button and rotating the dial knob. When you've got the one you want, you then either continue using the dial knob, or you enter the last four digits from the keypad. The whole thing is very inconvenient.

You write memories by holding down the MR/MW key while pressing the function key. You must hold it down for about one second, and entry is confirmed with a series of beeps. With the keypad beeper turned off, you can't tell whether entry is complete, because nothing happens on the display.

The displayed initials for some of the modes and functions are odd, and unexplained in the book. For example, the offset is "OW" and frequency skip is "PS." It's hard to remember this stuff if you are never told what it means.

Many programming procedures are complicated, and not all are consistent. For instance, most modes are terminated by pressing CLR, but the clock setting mode is terminated by pressing PTT—CLR won't work. Some procedures require holding the LIGHT button and a keypad button while turning the rig on. ICOM's walkies use procedures very different from those of the other major manufacturers, and in all fairness, I haven't had that much experience with the ICOMs. I suspect that if you have owned or used other ICOM HTs, this unit will be fairly easy to learn. If not, though, you're in for some surprises, and you will probably want to keep the crib sheet in your wallet.

The review unit did not come with the CTCSS or DTMF decoder boards, so I wasn't able to test those functions. However, the otherwise well-written manual is extremely confusing in the sections describing the use of the DTMF decoder, and I just couldn't make heads nor tails of it. For instance, two modes *pager* and *code squelch*, are offered, each with its own programming procedures. Except that one uses seven digits and the other uses three, I couldn't see the difference between them. Perhaps I could have tried the procedures, they would have made more sense.

ICOM's ads list the power output as 2 watts, yet the specs in the book list it as 1-1/2 watts. The actual power, as measured on my dummy load/wattmeter (admittedly no laboratory standard) was about 1.75 watts. Also, there are four power level settings available, but only two work with the internal battery. The other two work at higher voltages, such as from a car battery.

The back of the rig gets significantly warmer at 1.75 watts output than does my Yaesu FT-411 at 2.5 watts. This, and the very quick battery depletion, lead me to wonder whether the transmitter efficiency might be low. There are no current drain specs given for normal 7.2-volt operation (the only specs are for 13.8-volt use), so I can't know for sure.

As with most extended-receive rigs, there are some birdies and spurious responses, all well outside the ham band. In particular, a local FM radio station appears repeatedly in the 160 MHz band. None of the anomalies should affect normal use.

Unlike all the other microprocessor walkies I've used, this one does not use a standard lithium battery for backup. Instead, a *rechargeable* lithium battery is used. This might seem like a good idea, but the manual states that this battery will go dead and empty the memories about one week after the main battery is left discharged. So, if you run it down and then go out of town without it for a week, you may come home and find all 48 memories (and all your parameter programming) gone! ICOM may want to consider adding in seven-year lithium cells in future versions for memory/parameter management.

A Terrific Mini-Rig

This is one nifty little radio. Clearly, its greatest advantage is its size, suggesting that the best uses for it are those which do not require an external battery. After all, once you hang a battery on the bottom it isn't significantly smaller than other mini-rigs. If your usage is light, and especially if you can use low power (the company suggests that the internal battery will be discharged quickly on high power, and they aren't kidding), this rig offers you the ultimate in miniaturization. I'm sure it will prove popular. ICOM's definitely got a winner in the IC-2SAT! RF

Reprinted from the December 1989 issue of 73 Amateur Radio.

the tech side

by Michael Jay Geier KB1UM

I Know What That Thing Is

For the last couple of months, we've been examining the various kinds of components. You know how they say, "You can't work 'em if you can't hear 'em"? Well, you also can't fix 'em if you can't identify 'em! So, let's get back at it, so we can move on to something else next time.

Diodes: Identified by the callout letter D, diodes come in various sizes and types. The little ones are used for processing signals in all kinds of ways, and also for switching voltages around from circuit to circuit, in order to switch a radio between receive and transmit, for example. The big diodes are called rectifiers. What's the difference between a rectifier and a diode? Nothing; we're just used to calling the big ones by a different name. In general, though, power rectifiers are slower than signal diodes, and can't handle the frequencies involved in many signal-processing applications. At least that used to be true. Today, there are special, fast rectifiers, and you'll find them in switching power supplies. We'll get back to rectifiers in a moment; let's start with small-signal diodes.

Small Change

Diodes are shaped somewhat like small resistors, but they usually don't have color bands. Most diodes have glass bodies, and many are clear. Some, though, can be blue or another color. The identifying mark of a diode is the single band at one end. That signifies the cathode, or negative terminal.

Many small-signal diodes are pretty interchangeable, especially the 1N914 and similar silicon types. But, there are various other kinds, and some are extra-fast or particularly low-noise. The 1SS series finds a lot of use for switching and signal routing in radio receivers, thanks to its quiet nature. If you replace one with a standard '914, it'll probably work, but receiver noise most likely will go up quite a bit. Still, it can be handy to do that now and then when you just need to temporarily swap out a diode in order to see if you've found a circuit problem.

Now and then, you may find some odd diodes, including such types as Shottky barrier diodes, hot carrier diodes and even something called a tunnel diode, although those are extremely rare. These more exotic diode types cannot be replaced by regular switching diodes; you really need the same kind of part. Oh yeah, let's not forget the varactor diode. Actually, this thing is not a diode in the usual sense; it does not exhibit the one-way current path of a normal diode. Rather, it is a voltage-variable capacitor. Most PC boards call a varactor V, but I've seen some which used D. It can be confusing.

If you see a clear, glass diode which looks significantly bigger than most others, it may be a germanium diode. Germanium is an old semiconductor technology, dating back to the very beginning of the solid-state age. There used to be germanium transistors, too, but they've pretty much faded away because they were noisy and very failure-prone. The diodes, though, are still useful in some circuits because they have a lower voltage drop than do the silicon ones. That makes them more sensitive to small signals, so you are likely to find them in mixers and detectors. If you try to replace a germanium part with a silicon one, it usually won't work at all. If it does work, it will severely degrade the circuit's performance. Luckily, germanium diodes are still cheap and available. Even Radio Shack still sells the good ol' 1N60, 1N34A and similar types.

The Big Guns

Big diodes, or rectifiers, come in all sorts of shapes and sizes. You'll find plenty of them which look like bigger versions of the little diodes, except that the cases usually are black plastic. I've never seen a power rectifier with a glass body. Most rectifiers have the usual cathode band, but some omit it, using a bullet shape for the body to indicate the cathode, which is at the pointed end.

Most power rectifiers are fairly slow, and many types can be interchanged. Look for standard numbers like 1N4001 or 1N4003. The important specs to watch out for are the current rating and the PIV, or peak inverse voltage. The current rating refers to how much current the device can pass before it overheats and destroys itself. So, you should never use a replacement which has a lower current rating than did the original part. The PIV tells how high the voltage can be in the reverse direction before the diode will break down and blow out. Again, always make sure a new part has at least as high a rating as did the original.

"Most rectifiers have the usual cathode band, but some omit it, using a bullet shape for the body to indicate the cathode, which is at the pointed end."

High-speed applications like switching power supplies often use special power rectifiers which can handle the switching speed. You absolutely cannot use a standard 1N4000-series rectifier to replace one of those; it just won't work.

In many power supplies, you will see a square thing with four leads. What the heck is that? Most likely it's a bridge, or full-wave, rectifier. It's really not a special part. It's just four diodes wired together in the diamond-shaped configuration of a bridge circuit. In this case, though, the four diodes aren't separable, because they're all made together on the same substrate, like an IC chip. If you find a blown one, you can wire up four diodes into a classic bridge and replace it with them. As long as you get the polarities right, it'll work fine. Buying bridge rectifiers is no problem, but the old, discrete approach has saved my sanity many times in the middle of the night.

Some rectifiers are made of metal. Usually, that's to increase the current capacity of the part, by virtue of the faster heat transfer through metal. Other than their being beefier, there's nothing particularly different about metal rectifiers, unless they have studs and are mounted to heat sinks. Then, you're stuck with using another metal part.

Z Diode

There's one more kind of common diode, and it's a very important one. Zener diodes are used as voltage regulators in all kinds of circuits. They look a little different on a schematic, and many PC boards call them Z, as they should. But, I've seen plenty which called them D. The key is that the cathode is connected to the positive side of the circuit! With zeners, the forward direction behaves like any other diode. But, the reverse direction breaks down at a fairly precise voltage, and the breakdown doesn't harm the diode, as long as the part's current rating isn't exceeded. *Never* replace a zener with another type of diode, or you will lose your voltage regulation, possibly damaging other circuits. Zeners come in many voltage ratings, and it' s important to use the right one. Also, as with any diode, you've got to watch that current rating. Zeners are common failure points in just about all kinds of gear, so expect to see them often.

Crystals: Quartz crystals, marked X on a circuit board, are usually used as timekeepers. They provide the frequency stability in all kinds of oscillators and digital clocking circuits. They're indispensable in frequency synthesizers, local oscillators, computers, you name it. They also can be used in radio-frequency (RF) and intermediate-frequency (IF) filters.

Most crystals look pretty similar, with a flat, vertical metal can and two leads coming out the bottom. Many of the cans are the same size, but they do make crystals in very tiny cans for micro-sized radios, camcorders, wristwatches and such. Some of the crystals which are specifically meant to be used as filters have three leads: input, output and ground. And, some of those can be in plastic cases, usually orange or green.

Crystals and filters have all kinds of important characteristics, but the primary one is frequency. You just can't replace a crystal of one frequency with a different one and expect your circuit to work properly. Of course, if you have a dead oscillator and suspect the crystal, you might be able to try another one of a different frequency just to see if it oscillates. But, unless the frequencies are fairly close, it may not work, even though the circuit actually has nothing wrong with it. But, do crystals really go bad? You'd better believe it! In fact, they are fragile enough that a dropped rig which has suffered no other damage can sometimes have dead crystals. So, if an oscillator is dead or intermittent, it's worth suspecting the crystal. Unfortunately, due to the frequency issue, the chance of having another exact match is nil. So, I usually assume the crystal is good, unless I can prove otherwise.

Well, I was hoping we'd finish this up, but there's still a little bit more. Next time, we'll wrap it up and move on to another topic. Until then, 73 from KB1UM. RF

radio magic

by Michael Bryce WB8VGE

Since I work on the strangest work shifts in the world, most of my hamming is done in the wee hours of the morning. In fact, as I write this, it's a bit after three in the morning. I'm taking a break from the workbench, where a dead Heath QRP transceiver is sitting. I usually keep one of the rigs running in the background but this morning I decided to listen in to one of the oldies music broadcast stations. As they were playing the long version of "American Pie" my mind started to wonder just what the words mean in that song. So, that's how I got the idea for this month's column. No, not the meaning of lyrics in songs, but how to read schematics!

Fess up. I know you've done it, we all have. You get your brand-new radio, open up the box, flip through the instructions and bang, you're on the air. Buried deep down inside paper, beside the warranty card, you'll find a plastic bag containing the schematic diagram of your newest toy. You take a quick look. Whoa! You instantly throw it back into the box.

Reading Schematics

Now, I don't pretend to understand the function of each and every part listed on a schematic, but I can get from one end to the other and have a good idea what makes this thing tick. If nothing else, you should be able to at least understand the basic fundamentals of schematic reading. So, let's jump right in head-first.

I'll mention right off that some of the examples I'll be using are not carved into rock. There are always exceptions to every rule, so keep the hate mail down to a minimum, please. I'll be using the terms "mostly" and "usually" as there aren't really any rules that I'm aware of on how a schematic is drawn.

Usually, the schematic of a typical radio receiver will start on the left side of the paper and work its way toward the right. It's just like reading this page in *Radio Fun*.

Antenna connections are the first you'll see. Next, the mixers, IF stages and the product detector. Unless the print is very small, you can't get all of this on one page, so the schematic swings back to the left side and starts across the page again.

Most of the inputs are on the left and the outputs on the right. Don't bet the farm, but it's fair to assume this as being true most of the time.

All Those Inside Parts

So, great, you know what end to look for and what end to look at, but how about all those pieces and parts in between? Ah yes! While it's beyond the scope of this article to get into every possible combination of parts ever made, we'll look at some common configurations you'll see all the time. From the simplest QRP transmitter to the newest import from Japan, they all have something in common. So, let's start off with transistors—they're everywhere.

There are hundreds of speciality transistors, each with its own special symbol. A power MOSFET is really just a transistor with enhancements made to it. All you need to know are the two basic types—NPN and PNP. Whoa! Don't flip the page just yet! I'm not going to get into what the difference is between the two, just yet. All we need to know is how to tell them apart.

There are three pins on a transistor: the base, emitter, and collector. Most schematics I've ever read never spell out the base, collector or emitter leads with labels. It's taken for granted you know what the symbol of a transistor means. Sometimes, when doing voltage checks, there will be a chart with an "RCS" or "RBS" and a number beside it. This is the voltage at the collector or the base of that particular transistor. Also, you may see two different voltage readings. Sometimes the other value is contained in a circle. This is an easy way for the designer to show two different voltages under two different conditions. Perhaps one is during receive and the other is during transmit.

But, all you need to know right now is that a signal goes in on the base and out on the collector. Of course, there are exceptions, but for now, it's that simple. Look at Figure 1. Here is an NPN transistor. Notice the arrow on the emitter inside the circle. The arrow is pointing out. That's the first clue as to the identity of the transistor. Just remember the arrow inside the circle: NPN means Not Pointing iN. (It really means something else, but that's for another article.)

The NPN transistor will turn on when we apply at least 0.7 volts to the base. In this example, the transistor is said to be fully saturated, meaning it's fully on. As you can see, a small signal on the base will control a large signal on the collector. In the example shown, a small voltage applied to the base will control the lamp in the collector's lead. When the transistor turns on, the collector is now at ground potential, allowing current to flow through the bulb and light it up.

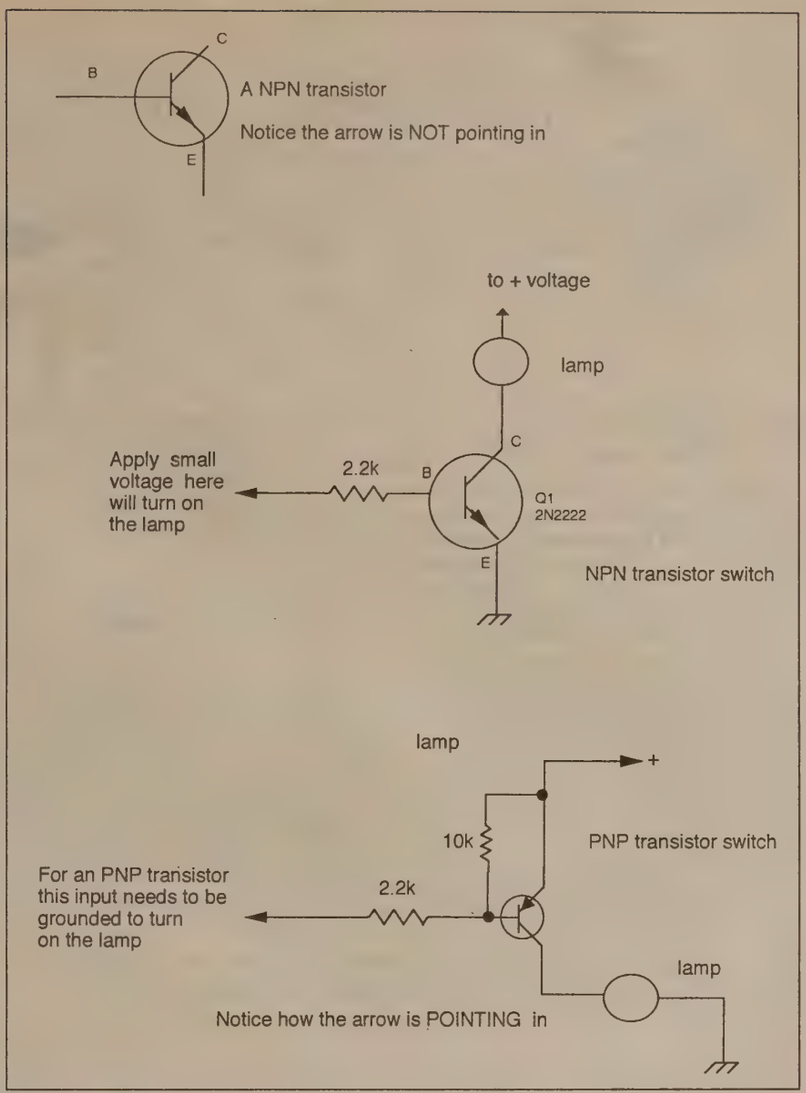

Figure 1. An NPN transistor, an NPN transistor switch, and a PNP transistor switch.

The PNP transistor, on the other hand, has the arrow in its collector pointing in the opposite direction from a NPN transistor. So, all you have to remember is Pointing iN Proudly. As you might expect, the PNP transistor works the opposite way as the NPN transistor. Take another look at the schematic. The PNP transistor has the lamp in series with the collector to ground. The supply voltage is applied to the emitter.

Notice the resistor between the emitter and the base. This guy is called a pull-up resistor. The resistor pulls the base of the transistor up to the supply voltage. That way, the base is not floating and just wondering around. To turn on the lamp, all we need to do is ground the base. Whoa! The lamp turns on because the PNP transistor is now fully turned on as well.

Also note the resistors on the base leads of both transistors. These guys limit the current flowing to the base. If they weren't there the transistor would be destroyed.

Either transistor can be turned on and off as fast the upper limit of the transistor. This means an RF signal will also turn the transistor on and off. Now, do you see how the transistor acts as an amplifier? A tiny amount of signal on the base controls a large signal on the collector.

These two examples will help you in making some sense out of a schematic. But, not to worry, we're not done yet. Nope, there's plenty to talk about. You'll need this information when we begin building our small QRP transmitter. RF

antennas, etc.

by Joseph J. Carr K4IPV

Five Things You Can Do with a Roll of Copperweld Wire

There it was: a bright, shiny, gleaming 1,000-foot roll of antenna wire. I had been shuttling around the fair grounds "hamfesting" for about three hours when I came across a guy who was "tailgating" antenna parts. Being something of an antenna wonk, I decided to waddle over to his area and see what could be had for how much. When I spotted the apparently new roll of wire, I took the loose end and confirmed that it was the kind of copper-clad steel wire that wire antenna freaks like me desire the most.

Known as Copperweld, after a brand-name, copper-clad steel core wire provides the best attributes of both copper wire and steel wire. It has the strength of steel wire, so it won't fall down as easily as all-copper wire. The copper wire has a tendency to stretch at its weakest point, and then break when the ice comes or the wind whips up. The copper-cladding reduces the radio frequency (RF) resistance to a low level because of the tendency of RF signals to flow on the surface of conductors (the well-known "skin effect"). So there it was . . . "my" wire, and it was cheap!

The roll was actually not new, but it had a clear plastic shrink-wrap around the spool to keep the wire together and not oxidized. I could tell from the corrosion on the loose end sticking through the wrapper that it was not a recent manufacture, and that seemed to be confirmed by what appeared to be a 10-year-old date code stenciled onto the spool.

Musing over what I could do with that spool of wire, I came up with a collection of wire antennas for high frequency (HF) shortwave use. My interests include both amateur radio (with a passion for 40 meter and 20 meter CW) and shortwave listening. So I thought up some antennas to try out. This column includes several of those that are best suited for shortwave listeners. Hams can use them too, but must cut them for the correct frequencies.

Thing No. 1: The Off-Centerfed Nonresonant Sloper Antenna

The off-centerfed nonresonant sloper antenna (OCFS) is a directional, wideband antenna that can be used over a large portion of the high frequency bands (see Figure 1). It provides marginal gain over a dipole, but its main attraction is its directivity and wide bandwidth. The antenna consists of two parts: radiator and radials. The radiator is three-quarter wavelength (3λ/4) at the lowest frequency of operation. This length in feet is found from $738/F_{MHz}$, where F_{MHz} is the frequency in megahertz (MHz). For example, if you want the lower end to be 6 MHz (i.e. 6,000 kHz) then the minimum length should be 738/6 = 123 feet.

The radiator is supported at the top end by a mast (preferably wood or some other insulating material, but metal will work also), and that mast should be 25 to 30 feet high. Alternatively, the top end support could be the roof of a building, or even a tree limb. The center conductor of the 75-ohm coaxial cable from the receiver is connected at this point.

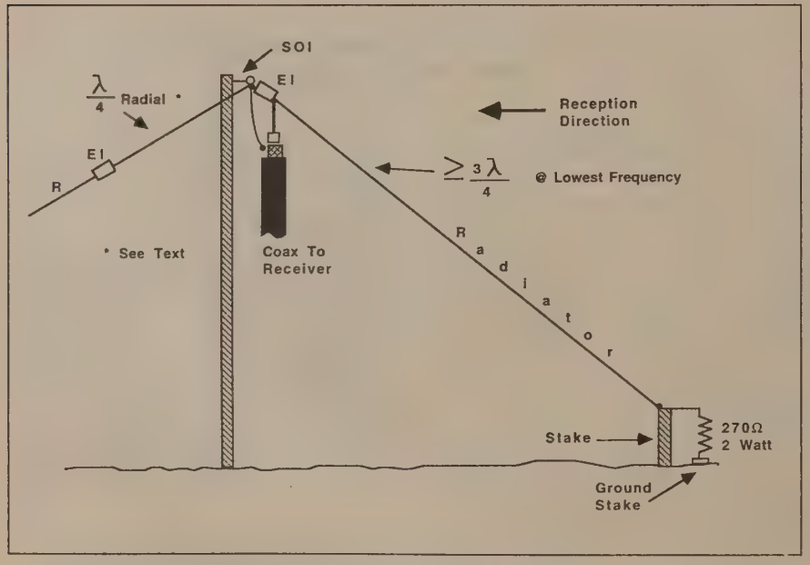

Figure 1. Off-centerfed sloper antenna.

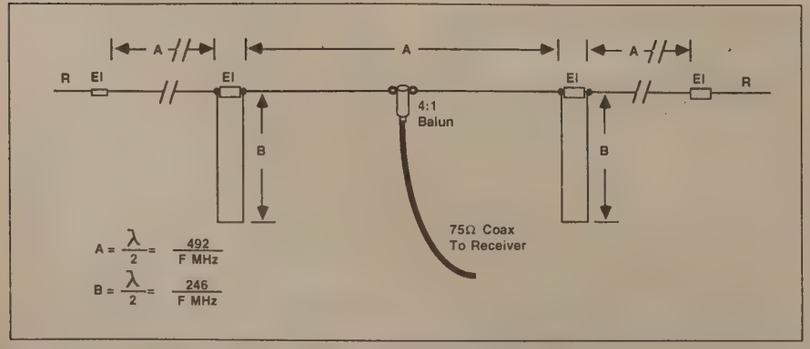

Figure 2. Collinear Franklin Array antenna.

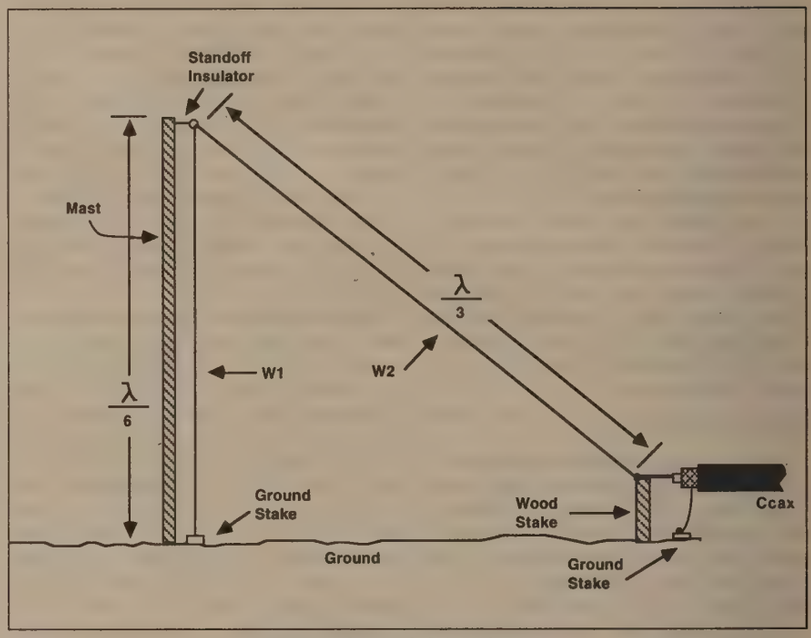

Figure 3. Half-delta sloper.

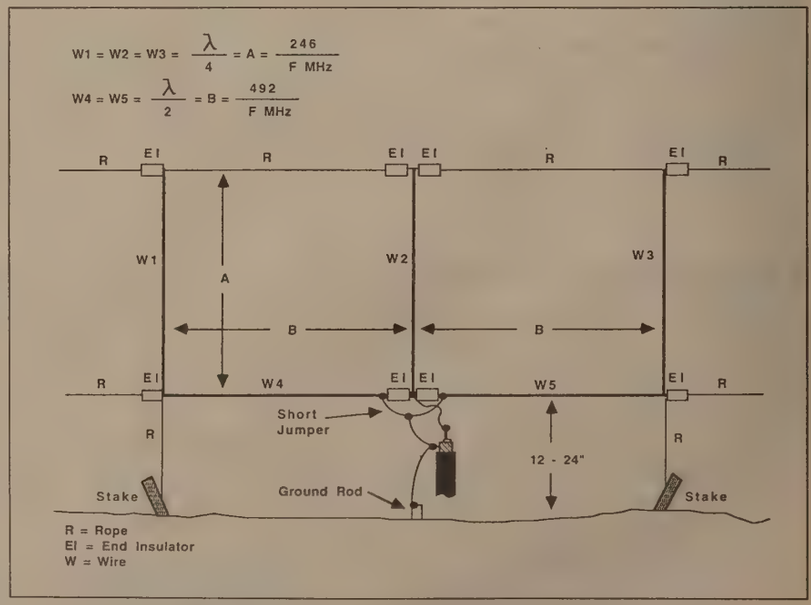

Figure 4. Thorne Array Bobtail Curtain.

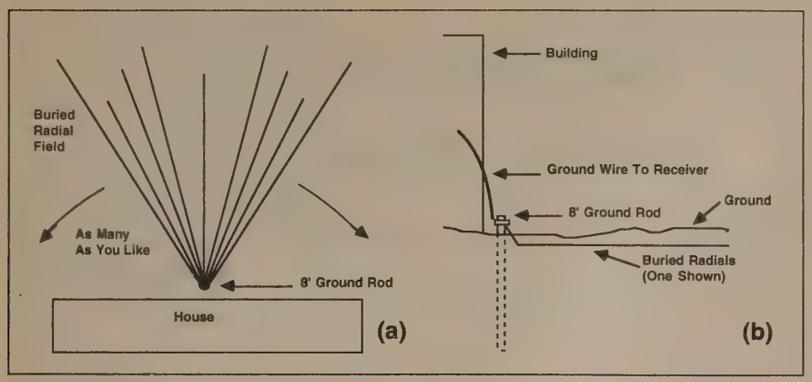

Figure 5. Super-ground radial system: a) top view; b) side view

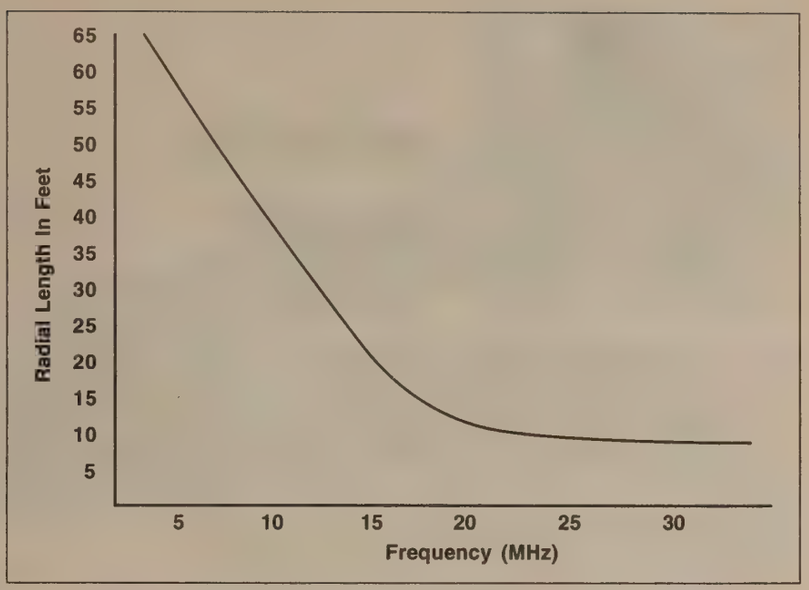

Figure 6. Radial length as a function of frequency for HF bands.

The bottom end of the radiator element is connected mechanically to a wooden stake or other insulating support a few inches above the ground. A grounded 270-ohm, 2-watt carbon or metal film resistor (*not* wire-wound) is connected between the wire and a ground rod.

The effectiveness of the antenna is improved by using a resonant radial on each major band of operation in the HF region. This radial should be one quarter wavelength ($\lambda/4$), and its length in feet is found from $246/F_{MHz}$. In general, cut the radial for the middle of the band of interest. For example, for the 31 meter band (11.5-12 MHz) use 11.75 MHz as the cut frequency. This radial is 246/11.75 = 20.9 feet. Connect the radial(s) to the shield (outer conductor) of the coaxial cable transmission line. Although only one radial is shown, as many as mechanically fit can be used, each with its own end insulator (EI) and rope (R).

Thing No. 2: The Collinear Franklin Array

The Collinear Franklin Array (CFA) antenna (Figure 2) is almost as simple to erect as a half-wavelength dipole (that perennial favorite of antenna buffs), but provides gain of 3 to 4.5 dB. The CFA consists of either three (3 dB gain) or five (4.5 dB gain) horizontal half-wavelength ($\lambda/2$) radiators. The center radiator element is fed at the center (the same as a dipole), but with a 4:1 balun transformer (rather than the 1:1 balun used by dipoles). The transmission line to the receiver is 75-ohm coaxial cable.

The two or four end radiator elements are insulated from the center radiator and from each other with an end insulator (EI). At each insulator a quarter wavelength ($\lambda/4$) phase reversal stub is provided. This stub provides the phasing needed to achieve the gain of the antenna. Each stub can be made from 450-ohm twin-lead, or with parallel transmission line homemade from 4" spreaders and antenna wire. If the open-wire parallel method is chosen, then the stub (length "B") is $246/F_{MHz}$ feet long; if 450-ohm twin-lead is used, the velocity factor must be accounted for so the length is $202/F_{MHz}$ feet long. For our 31 meter band, at 11.75 MHz, the lengths of "B" are 20.9 feet for open-wire and 17.2 feet for 450-ohm twin-lead.

The phasing stubs can be left dangling from the antenna. Although some people might see it as a little tacky, it looks more "radio-like" . . . and besides, those people think any antenna looks tacky.

Thing No. 3: The Half-Delta Sloper (HDS) Antenna

The half-delta slope (HDS) antenna is basically a one-wavelength delta loop antenna, but with half of the structure treated as a "mirror image" in the ground. The antenna is bidirectional, with gains of 1.5 to 2 dB possible.

There are two sections to the HDS antenna: vertical and sloped. The vertical section (W1) is $\lambda/6$ long and is grounded at the bottom end, while the sloped section (W2) is $\lambda/3$ long. These lengths are $W1 = 164/F_{MHz}$ and W2 = 328/FMHZ. For our 31-meter example, W1 = 14 feet and W2 = 27.9 feet.

The HDS antenna offers a feedpoint impedance close to 75 ohms at the resonant frequency. At harmonics, however, the antenna also performs well, but the feedpoint impedance may rise as high as about 1,000 ohms. For harmonic application, an impedance matching antenna tuning unit (ATU) should be used.

Mechanically, the vertical section is supported by a wooden mast, while the bottom end is attached to a wooden stake driven into the ground. If a metal mast of the correct resonant length can be provided, then it can be used to replace the vertical section of the HDS.

"The off-centerfed nonresonant sloper antenna (OCFS) is a directional, wideband antenna that can be used over a large portion of the high frequency bands. It provides marginal gain over a dipole, but its main attraction is its directivity and wide bandwidth."

Thing No. 4: The Thorne Array Bobtail Curtain (TABC) Antenna

The Thorne Array Bobtail Curtain (TABC), shown in Figure 4, is basically a standard Bobtail curtain array turned upside down, and fed in a different manner. Bidirectional gains up to 5 dB have been measured on 15 meters, although I suspect that the gain is due largely to compression of the elevation lobe of the antenna. This antenna has a very low angle of radiation, so it works well for long DX in the upper end of the shortwave spectrum. On the 15 meter ham band, from a location in Texas, very loud Australian and New Zealand stations I've worked were a lot less audible on the quarter wavelength vertical and dipole antennas at the same location (and received much better signal reports of my own signal).

The TABC consists of three vertical quarter-wavelength ($\lambda/4$) radiators (W1,W2 and W3) separated by half-wavelength ($\lambda/2$) phasing elements (W4 and W5). The two outer vertical elements (W1 and W3) are electrically connected to the corresponding phasing element (W1 to W4, and W3 to W5), but insulated from the center vertical element (W2). The two phasing elements (W4 and W5) are electrically connected to each other by a very short jumper wire. The center conductor of the 52 ohm coaxial cable to the receiver is connected to the base of the center vertical element (W2), while the coax shield is connected to the jumper between phasing elements W4/W5, and to ground.

The lengths of the two sections are $A = 246/F_{MHz}$ feet and $B = 492/F_{MHz}$ feet. For the 24 MHz band, the vertical sections are 11.5 feet long, while the phasing sections are 20.5 feet long.

Mechanically, the antenna is basically supported by dipole-like antenna end insulators (EI) and ropes (R) to various masts or support structures (trees, buildings, etc.). If you prefer, the vertical sections can be replaced with 0.5" to 2" aluminum tubing, but you will have to provide some form of mounting for the tubing.

Thing No. 5: A Super Ground System

Shortwave antennas tend to work better when installed over a really good ground system. In some parts of the country, like a soggy brackish swamp, a three-foot stake in the ground is more than enough for good signal reception. Indeed, I know an AM radio station engineer who was astounded by how high his signal levels were at a newly constructed transmitter site that was on the edge of the Dismal Swamp (VA-NC border). For other locations, however, an artificial ground system made of quarter wavelength radials is used. Each radial is $246/F_{MHz}$ feet long.

Figure 5 shows the "super-ground" system: A bird's-eye view is shown in Figure 5A; Figure 5B shows a side-view. For safety reasons, the radials should be buried at least six inches down. It's OK if the wire is not insulated, by the way. The easiest way is to do like my old friend Abe did: He went to his newly-built house prior to the sod being delivered and installed the ground system for his ham radio antennas. Of course, Abe was a little, uhhh, different (he also buried an antique copper bathtub near the footers of the house, and then connected the radials to it). Another method is to use a shovel or spade to cut slit trenches for each radial. This is a lot of work, but within the range of possibility, especially if done over a period of time.

The radials are all connected to an eight-foot copper-clad steel ground rod buried up to the last six inches in the ground. Electrical shops (not electronic) often carry these rods, although a few electronic shops also carry them. All radials are connected in parallel with the rod. A heavy wire is passed from inside the house, and then connected to the ground rod/radial system. This wire is connected to the ground terminal on the back of the receiver.

The lengths of the radials for the HF band can be found from Figure 6, or calculated from $246/F_{MHz}$. Try to use at least two radials for each band, or if you cover the spectrum for each MHz or so.

For Further Reading

Additional information about these and other antennas can be found in the *Practical Antenna Handbook*, 2nd Edition (TAB/McGraw-Hill, 1-800-233-1128), and in Joe Carr's *Receiving Antenna Handbook* (High-Text Publications 1-800-247-6553). Antenna and radial lengths for frequencies other than those shown can be calculated using an ordinary hand-calculator, or by using the Antlers (MS-DOS) or Antlers for Windows software. The MS-DOS version is $20, while the Windows version is $30. Contact me at P.O. Box 1099, Falls Church, VA 22041 if you want that software. RF

what's next?

by Carole Perry WB2MGP

How Do You Go to the Bathroom In Space?

At the end of the school year, I always like the children in my ham radio classes to review the projects and activities they enjoyed most during the school term. This is not only an educationally-sound thing to do, it also helps me to evaluate how well the term went and to better plan for the next year.

Overwhelmingly, most of the students enjoy the unit on "Space Travel and Communication" the best. This year we decided to put together a compilation of the most interesting facts we learned about space travel. The class was divided into groups with their own specific goals. One group made a listing of the most fascinating facts they learned that term. Another group was in charge of compiling the funniest things. Still other children put together a log of all the contacts we had made that year with the Johnson Space Center or any other NASA affiliate.

With the help of our logbooks, the students' notebooks, and reference books such as William Pogue's *How Do You Go To The Bathroom In Space?* book, the children did a great job gathering all the data to provide a terrific end-of-term review. The following are some of the highlights that we all enjoyed hearing about again and, in many cases, laughing about again.

The Best Questions

Question: What kind of clothes do astronauts wear in space?

Answer: Life on board the shuttle is designed to be as comfortable and practical as possible. The astronauts usually wear trousers, T-shirts (each crew designs their own patch for their shirts), and jackets. The pants have several pockets with zippers or flap covers held closed with Velcro. It is important that the pockets stay properly fastened so that objects inside them don't float out. The underwear is commercially-manufactured briefs and T-shirts.

Shuttle astronauts have a wide range in their clothing selections: one-piece coveralls, shorts with T-shirts, jackets, etc. On board the shuttle, most of the crew seems to prefer working in stocking feet. The astronauts select their flight clothing at the Flight Equipment Processing Facility located near the Johnson Space Center at Houston, Texas. This facility assembles the food, clothing, space suits, cameras, special instruments, calculators, tools, etc., that are needed for each flight.

Question: Do the astronauts float in microgravity when they sleep?

Answer: If the astronauts simply floated freely while they slept they would drift with the air currents and bump into things. Instead, they sleep in sleeping bags supported by a tubular metal frame that gets strapped to the wall of their individual sleep compartments. They slip into the sleeping bags feet-first, through the neck holes. There are side slits for their arms to go through. Extra sleeping bag wraps can be zipped in for extra warmth. The airflow, light, and temperature can be controlled in each sleep compartment.

Question: How do you tell time in space?

Answer: There is no "natural" time zone for space. It is necessary, however, to use a single time standard to avoid confusion in scheduling different mission activities. This standard is referred to as GMT (Greenwich mean time), the time at Greenwich, England. If you include the date and year as well, the time is referred to as UT (universal time).

To tell time during a space mission, the astronauts wear commercial wristwatches and also have several electronic clocks on board the shuttle. The daily routines (work/sleep times) are based on central time in the United States. The wake-up call usually comes at 6:00 a.m. U.S. central standard time (CST). Naturally, day and night periods in orbit change much faster than on earth (16 sunrises and sunsets every 24-hour earth day). Experiments and work tasks are scheduled on GMT. The work shifts at Mission Control and the astronauts' meals are scheduled on the CST cycle. Some astronauts wear two watches—one with GMT and one with CST—so that they have both times available.

For short missions, mission elapsed time (MET) may be used. MET is useful when it is important to schedule events from lift-off (launch) time. If the lift-off time changes due to a delay, the MET schedule (flight plan timeline), based on the actual lift-off time, will still be usable. An event scheduled for MET 4:26 would be four hours and 26 minutes after lift-off.

Question: How do the astronauts go to the bathroom on a space walk?

Answer: This probably gets the award for the most frequently asked question by school kids of the astronauts who have gone on space walks. I've personally heard the answer given by several astronauts, and I always enjoy watching the kids' faces. They seem to enjoy the act of asking this question as much as listening to the response. So be prepared if your class gets a chance to speak via the radio to an astroham. Even if they already know the answer . . . I'll bet that some youngster will ask it anyway.

There are actually two devices worn under the space suit for this accommodation: a UCD (urine collection device) and an FCS (fecal containment system). For space walks there are several options for urine collection. Male crew members may use the UCD or commercial adult diapers. Female crew members may use the adult diapers or a garment called a DACT (disposable absorbent containment trunk). The DACT is similar to the adult diaper, but much more absorbent.

For launch and re-entry, the same options of urine collection are employed.

If you have a group of students who have participated in a SAREX (Shuttle Amateur Radio Experiment) contact, or who have spoken to astronauts via the radio from some earthly location, please share your kids' questions and experiences. Get in touch with me so we can compile a list of what the children are interested in and want to know more about.

Send all correspondence to Carole Perry WB2MGP P.O. Box 131646 Staten Island, N.Y. 10313-0006. RF

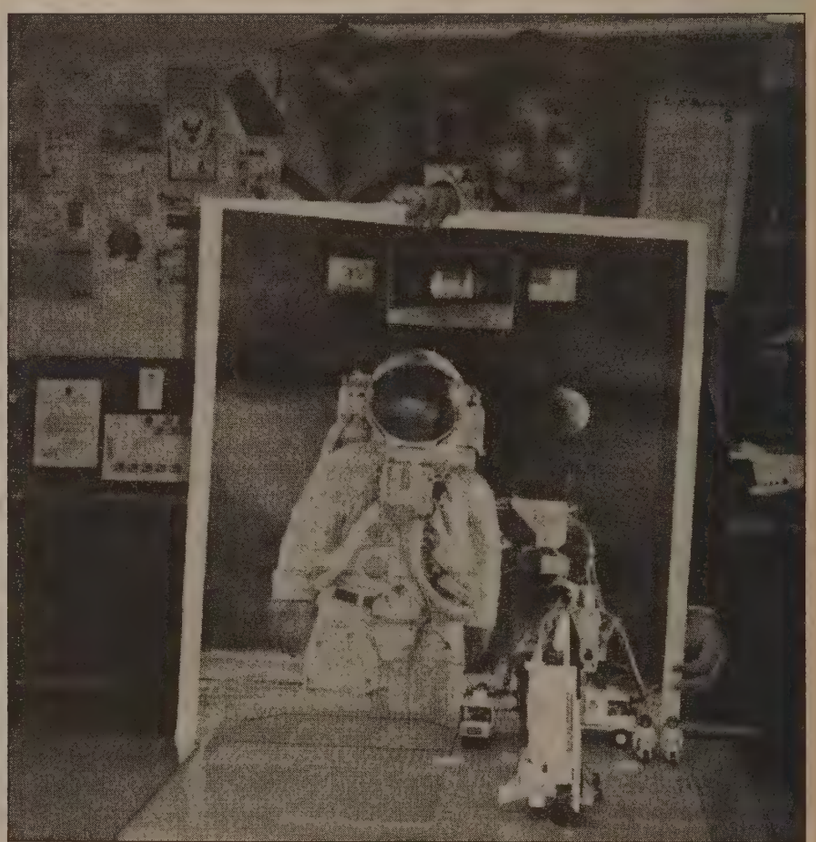

Photo A. Sixth-grader Dean helped compile a list of fascinating facts about space travel and communication.

upgrade ... don't stop now

by Gordon West WB6NOA

Skywaves for No-Code Techs

Working skip communications off of the ionosphere is one of those "ultimate experiences" that every ham looks forward to. Regular skip conditions on the 10 meter band entice no-code Technician Class operators to pass their 5 wpm code test and earn Technician-Plus skywave privileges.

No skip for no-coders? Not so! The no-code Technician Class operator has full privileges from 50 to 54 MHz, and 1,000-mile skywaves on 6 meters occur more often than you might think. If you've always wanted to work skywave DX, but only have the no-code Technician Class license, *read on* about the excitement of 6 meters.

The first sidebar shows the 6 meter band plan recommended by the American Radio Relay League.

When you look over the equipment catalogs, you might think that all high-frequency SSB transceivers don't go above 30 MHz to give you 6 meters. That's true, most don't. And when you think about VHF/UHF FM dual-band and triband equipment, the 6 meter band is usually not offered. This is the secret of 6 meters—equipment and antennas are indeed available if you know what you are looking for:

- Alinco—New mobile radio for 6 meters, FM.
- Azden—Hand-held and mobile 6 meter FM equipment.
- Comet—Antennas covering 6 meters, base and mobile.
- Cushcraft—Beams and verticals for 6 meters.
- Diamond—Antennas for 6 meters.
- Hustler—Antennas for 6 meters.
- HyGain—Antennas for 6 meters.
- ICOM—IC-736 HF transceiver including 6 meters SSB and FM.
- ICOM—IC-901 mobile with 6 meter module.
- ICOM—IC-575H 6 and 10 meter FM/SSB transceiver.
- Kenwood—TS-60 major 6 meter, 95-watt transceiver.

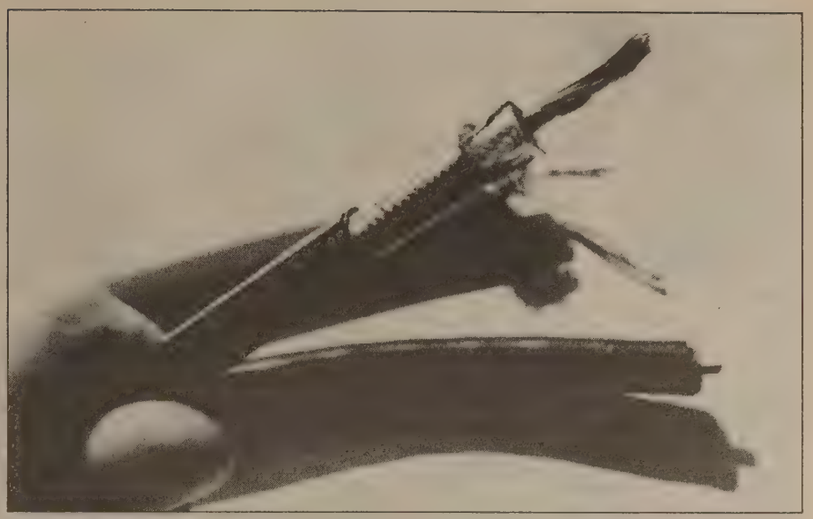

Photo A. For best 6 meter range, use double-sheilded semi-rigid coaxial cable like this Belden #9913 or equivalent.

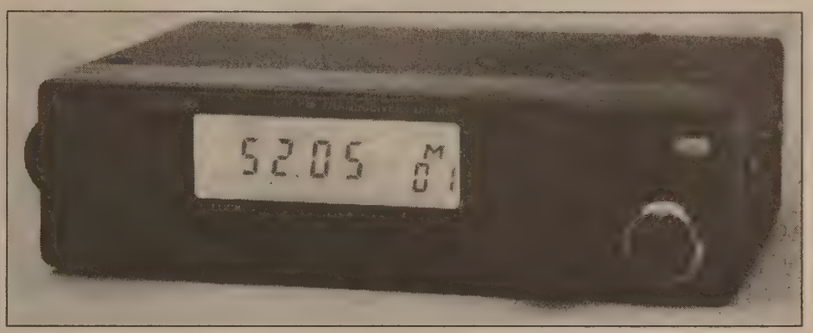

Photo B. The new Alinco 6 meter FM mobile transceiver.

advertiser index

Photo C. Southern California VHF enthusiasts using Azden 6 meter portable FM handhelds.

- Kenwood—TS-690S HF transceiver with 6 meters.
- KLM—6 meter monster beam antennas.
- Larsen—6 meter mobile antennas.
- MFJ—Multiband antennas including 6 meters.
- Mirage—6 meter amplifiers.
- Standard—6 meter handheld soon?
- Yaesu—FT-736 multimode with 6 meter module.
- Yaesu—FT-690R 10-watt, 6 meter mobile.

So, from A to Z (OK, A to Y), the equipment manufacturers and antenna makers have you covered on the 6 meter band.

Six meter FM is fine for staying in touch around town through repeaters. The range of 6 meter repeaters is similar to 2 meter range-through repeaters. Six meter signals propagate better through hills and trees than any other band, so 6 meter repeater use is great in hilly terrain.

Six meter handhelds do a relatively good job in hitting most repeaters—I have tried the Azden, and it works nice. However, the little rubber duck antenna is only effective on a line-of-sight basis. For better repeater communication range, hook into an outside 56" whip or mobile base-loaded whip. You can triple your range easily.

You can find 50 MHz FM simplex at 52.525 MHz nationwide, and 50.3 MHz in selected areas around the country. *No FM activity is allowed below 50.3 MHz.*

But a no-code Technician would surely like working skywaves—and while you can do it now and then on FM, going to 6 meter single sideband (upper sideband) or 6 meter CW will give you the best results when the band opens. A "band opening" is when the signals reflect off heavily ionized patches in the E-layer, and come back down 1,500 to 2,000 miles away. Single sideband is the ultimate mode for maximum range because your noise floor is substantially reduced by tighter bandwidth, and this narrow bandwidth is best suited for minimum fading as the signal goes through various layers of the ionosphere.

MHz	Use
50.100–50.300	SSB, CW
50.100–50.125	DX window
50.110	SSB calling frequency
50.300–50.600	Non-voice communications
50.620	Digital/Packet calling frequency
50.800–50.980	Radio control
	20 kHz channels
51.000–51.100	Pacific DX window
51.120–51.480	Repeater inputs (19)
51.120–51.180	Digital repeater inputs
51.620–51.980	Repeater outputs (19)
51.620–51.680	Digital repeater outputs
52.000–52.480	Repeater inputs (23)
52.020, 52.040	FM simplex
52.500–52.980	Repeater outputs (23)
52.525, 52.540	FM simplex
53.000–54.480	Repeater inputs (19)
53.000, 53.020	FM simplex
53.1/53.2/53.3/53.4**	Radio control**
53.500–53.980	Repeater outputs (19)
53.5/53.6/53.7/53.8**	Radio control**
53.520	Simplex
53.900	Simplex

**Optional, local choice

ARRL 6 meter wavelength band plan, 50.0-54.0 MHz.

Six meter ionospheric band openings usually occur in the summer months from June to September. This is when we have the greatest occurrence of sporadic-E "clouds" invisibly drifting from west to east 200 miles up. There is another peak in ionospheric activity around December, and the greatest chance of a band opening occurs right after sunup, or in the early evening hours. One minute you're listening to background hiss at 50.150, a good SSB calling frequency, and the next minute your radio dial is filled with incoming stations that are 1,500 miles away calling CQ. Many times a local TV station on Channel 2 will look fuzzy, and this is a good sign that the 6 meter band is ready to skip across the country.

Six meter band openings into South America sometimes occur in the wintertime; and if you live in the northern section of the United States, you might also experience 6 meter auroral contacts, too, over distances exceeding 600 miles.

Six meters is not for sissies. You will be working with big beams to launch your signal into the ionosphere. Mobile antennas are 54 inches long, and power levels up to 1,500 watts can be used for skywaves, auroral reflections, and even moonbounce. If 2 meters is getting routine for you, do consider the lure of 6 meters. Six meters is the band the big boys hang out on, and there are some valuable experiences to be learned on working the world and all continents on 6 meter single sideband. It's a band full of surprises! RF

INPUT	OUTPUT	USE	INPUT	OUTPUT	USE
Note 1	52.71	S-21	52.05	53.75	R-48
Note 1	52.73	S-22	52.07	53.77	R-49
Note 1	52.75	S-23	52.09	53.79	R-50
Note 1	52.77	S-24	52.11	53.81	R-51
Note 1	52.79	S-25	52.13	53.83	R-52
51.11	52.81	R-1	52.15	53.85	R-53
51.13	52.83	R-2	52.17	53.87	R-54
51.15	52.85	R-3	52.19	53.89	R-55
51.17	52.87	R-4	52.21	53.91	R-56
51.19	52.89	R-5	52.23	53.93	R-57
51.21	52.91	R-6	52.25	53.95	R-58
51.23	52.93	R-7	52.27	53.97	R-59
51.25	52.95	R-8	52.29	53.99	R-60
51.27	52.97	R-9	-----	52.31	S-1
51.29	52.99	R-10	-----	52.33	S-2
51.31	53.01	R-11	-----	52.35	S-3
51.33	53.03	R-12	-----	52.37	S-4
51.35	53.05	R-13	-----	52.39	S-5
51.37	53.07	R-14	-----	52.41	S-6
51.39	53.09	R-15	-----	52.43	S-7
51.41	53.11	R-16	-----	52.44	S-8
51.43	53.13	R-17	-----	52.47	S-9
51.45	53.15	R-18	-----	52.49	S-10
51.47	53.17	R-19	-----	52.51	S-11 Note 2
51.49	53.19	R-20	-----	52.53	S-12 Note 2
51.51	53.21	R-21	-----	52.55	S-13
51.53	53.23	R-22	-----	52.57	S-14
51.55	53.25	R-23	-----	52.59	S-15 Note 3
51.57	53.27	R-24	-----	52.61	S-16 Note 3
51.59	53.29	R-25	-----	52.63	S-17 Note 3
51.61	53.31	R-26	-----	52.65	S-18 Note 3
51.63	53.33	R-27	-----	52.67	S-19 Note 3
51.65	53.35	R-28	-----	52.69	S-20 Note 3
51.67	53.37	R-29	-----	52.71	S-21 Note 3
51.69	53.39	R-30	-----	52.73	S-22 Note 3
51.71	53.41	R-31	-----	52.75	S-23 Note 3
51.73	53.43	R-32	-----	52.77	S-24 Note 3
51.75	53.45	R-33	-----	52.79	S-25 Note 3
51.77	53.47	R-34			
51.79	53.49	R-35			
51.81	53.51	R-36			
51.83	53.53	R-37			
51.85	53.55	R-38			
51.87	53.57	R-39			
51.89	53.59	R-40			
51.91	53.61	R-41			
51.93	53.63	R-42			
51.95	53.65	R-43			
51.97	53.67	R-44			
51.99	53.69	R-45			
52.01	53.71	R-46			
52.03	53.73	R-47			

NOTE 1
DX Window protection, 51.0 to 51.1 MHz. Would be outputs are simples frequencies.

NOTE 2
Simplex channels S-11 and S-12 are not to be used for a period of 5 years, protecting 52.525. After that 52.53 would become the national calling frequency

NOTE 3
Simplex channels S-15 thru S-25 would be used for single frequency packet operation.

Input/output spacing	1.7 MHz
Channel spacing	20 kHz—odd-numbered frequencies
Number of repeater pairs	60 in low/out high
Number of simplex channels	25
Spectrum used	51.110-53.990 MHz

The 1.7 MHz Plan: A Six Meter Plan presented by The Columbia Region Six Meter Association, representing Washington, Oregon, and British Columbia.

Uncle Wayne's Bookshelf

BOOKS FOR BEGINNERS

02D42 **Digital Novice** *by Jim Grubbs* Geared to make you a more knowledgable participant. **$8.50**

20N018 **Technician Class License Manual: New No-Code** *by Gordon West* This book covers everything you need to become a Technician Class Ham. Every question and answer on the examinations is found in this one book. FCC Form 610 application. **$9.95**

20N092 **The Wonderful World of Ham Radio** *by Richard Skolnik, KB4LCS* Simple, clear, and fun. Introduces young people to amateur radio. **$7.95**

AR2871 **W1FB's Help for New Hams** *by Doug DeMaw W1FB* Complete for the newcomer. Put together a station and get on the air. **$10.00**

AR2286 **First Steps in Radio** *by Doug DeMaw W1FB* Series of *QST* articles. **$5.00**

SHORTWAVE

06S57 **1993 Passport to World Band Radio** *by International Broadcasting Services, Ltd* You'll get the latest station and time grids. **$16.50**

03S11 **Shortwave Receivers Past and Present** *edited by Fred J. Osterman* Guide to 200+ shortwave receivers manufactured in the last 20 years. The Blue Book of shortwave radio value. **$8.95**

07R25 **The RTTY Listener** *by Fred Osterman* New and expanded. This specialized book compiles issues 1 through 25 of the *RTTY Listener Newsletter.* Contains up-to-date, hard-to-find information on advanced RTTY and FAX monitoring techniques and frequencies. **$19.95**

03M221 **US Military Communications (Part 1)** US Military communication channels on shortwave. Covers frequencies, background on point-to-point frequencies for the Philippines, Japan and Korea, Indian and Pacific Oceans, and more. **$12.95**

03M222 **US Military Communications (Part 2)** Covers US Coast Guard, NASA, CAP, FAA, Dept. of Energy, Federal Emergency Management Agency, Disaster Communications, FCC, Dept. of Justice. From 14 KC to 9073 KC. **$12.95**

03M223 **US Military Communications (Part 3)** Completes the vast overall frequency list of US Military services, from 8993 KC to 27,944 KC. **$12.95**

09S42 **The Scanner Listener's Handbook** *by Edward Soomre N2BFF* Get the most out of your scanner radio. **$14.95**

11T88 **Tune in on Telephone Calls** *by Tom Kneitel K2AES* Formatted as a frequency list with detailed description of each service and its location in RF spectrum. **$12.95**

03K205 **Guide to Radioteletype (RTTY) Stations** *by J. Klingenfuss* Updated book covers all RTTY stations from 3MHz-30MHz. Press, Military, Commercial, Meteo, PTTs, embassies, and more. **$12.95**

11AS10 **Air Scan Guide to Aeronautical Communications (5th Ed.)** *by Tom Kneitel K2AES* Most comprehensive guide to monitoring US aeronautical communications. Covers all Canadian land airports and seaplane bases, plus listings for Central America, the Caribbean, North Atlantic, and the Pacific Territories. **$14.95**

15A002 **Scanner and Shortwave Answer Book** *by Bob Grove* Most frequently asked questions by hobbyists. **$13.95**

07A66 **Aeronautical Communications Handbook** *by Robert E. Evans* Exhaustive, scholarly treatment of shortwave aeronautical listening. **$19.95**

11RF13 **The "Top Secret" Registry of US Government Radio Frequencies (7th Ed.)** *by Tom Kneitel K2AES* This scanner directory has become the standard reference source for frequency and other important information relating to the communications of federal agencies. **$19.95**

11F52 **Ferrell's Confidential Frequency List, New Revised Edition** *compiled by A.G. Halligey* All frequencies from 4 MHz-28MHz covering ship, embassy, areo, Volmet, Interpol, numbers, Air Force One/Two, more. **$22.95**

11SR97 **National Directory of Survival Radio Frequencies** *by Tom Kneitel K2AES* Handy and concise reference guide to high interest communications frequencies required by survivalists. **$8.95**

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RF 11/94

Radio Fun flea market

Turn your old ham and computer gear into cash now. Sure, you can wait for a hamfest to try and dump it, but you know you'll get a far more realistic price if you have it out where 30,000 active ham potential buyers can see it, rather than the few hundred local hams who come by a flea market table. Check your attic, garage, cellar, and closet shelves and get cash for your ham and computer gear before it's too old to sell. You know you're not going to use it again, so why leave it for your widow to throw out? That stuff isn't getting any younger!

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activities calendar

Send your announcements to: Radio Fun Activities Calendar, 70 Route 202-N, Peterborough NH 03458. We'll print as many as space allows, on a "first come-first listed" basis.

NOV 26

EVANSVILLE, IN Vanderburgh County Fairgrounds will be the location of the 2nd Annual E.A.R.S. Evansville Winter Hamfest. Festivities from 8 AM-2 PM Central. Flea Market. Commercial Dealers. Talk-in on EARS Rptr Net.; Evansville 145.150(-); Vincennes 146.925(-). Contact *Bev KA9PDG, (812) 479-5741;* or write *EARS, 1506 S. Parker Dr., Evansville IN 47714.*

DEC 3

GREENSBORO, NC The 14th annual Greater Greensboro Hamfest and Computer Show will be sponsored by the 76 Group at Greensboro Coliseum Complex Special Events Center, 1921 West Lee St., 9 AM-4 PM. Flea Market, Commercial Booths, VE Exams (pre-register), Computers, more. Talk-in on 145.250(-) and 146.760(-) Contact *76 Group, P.O. Box 7862, Greensboro NC 27417-0862,* or call *REALTALK, (910) 299-2525. Enter 0076* at the prompt.

MESA, AZ The Superstition ARC Hamfest will be held at Mesa Community College Campus, NE corner of Dobson Rd. & SR 60 (Superstition Freeway). For info, call *(602) 898-9158.*

NORTH OLMSTED, OH The North Coast ARC Fall Hamfest will be held at St. Clarence Church, 30106 Lorain Rd., 8 AM-2 PM. Setup at 0600 AM. Vendors purchasing four or more tables may set up Fri. eve. 7 PM-10 PM. Reservation payments must be received (with SASE) by Nov. 26th. Send to *Dan Sarama KB8A, 15591 Rademaker Blvd., Brook Park OH 44142. Tel. (216) 267-5083,* or connect to the *NCARC Packet BBS, "C NO8M" on 145.73. Dial (216) 779-6350* and use the commands: *D NCARC/HAMFEST.LOC* and *D NCARC/HAMFEST.INF.* Talk-in on 145.29 and 224.76 Rptrs.

DEC 4

HAZEL PARK, MI Hazel Park H.S., 23400 Hughes St., will be the location for the 29th Annual Swap and Shop sponsored by the Hazel Park ARC. Admission $4, tables $13 (check must be sent, no reservations by phone). Talk-in on 146.64(-) (DART). For info, tables, tickets, write to *HPARC, Box 368, Hazel Park MI 48030.*

DEC 10

FARIBAULT, MN The annual Courage Center Handi-Ham Winter Hamfest will be held at the Eagles Club, starting with registration at 8:30 AM. There will be a Handi-Ham Equipment Auction, Flea Market, Dinner at Noon, and Program. Talk-in on 19/79. Contact *Don Franz W0FIT, 1114 Frank Ave., Albert Lea MN 56007.*

JACKSONVILLE, IL Three major clubs are coming together to sponsor a Superfest at 8 AM in the Turner Jr. H.S. VE Exams, Flea Market. Crafts welcome. Contact *Tim Childers, (217) 245-2061.* Talk-in on 146.775 Rptr., and on 146.52.

JAN 8

MILWAUKEE, WI The 23rd annual Mid-Winter Swapfest will be held at the Waukesha Co. Expo Center Forum from 8 AM-2 PM. Advance reservation deadline is Dec. 23rd. VE Exams; please pre-register. Sponsored by the West Allis RAC. Write with SASE to *WARAC Swapfest, P.O. Box 1072, Milwaukee WI 53201.*

JAN 14

LANCASTER, PA The Columbia Area ARC will present its annual "Dutch Country Computer and Communications Show" from 9 AM-2 PM at the Lancaster Host Resort and Conference Center, Route 30 East. FCC Exams (must pre-register by Dec. 31st. 1994). Talk-in on 146.715(-). Address inquiries to *Dutch Country Computer and Comm. Show, P.O. Box 682, East Petersburg PA 17520.* Exhibitors, call *(717) 560-2072;* or FAX to: *(717) 872-0857* (include Company name/address).

APR 28-30

DAYTON, OH The Dayton Hamvention will be held at Hara Arena by the Dayton ARA Inc. Giant 3 day Flea Market, Exhibits, and Activities for the Non-Ham. For more information, connect to the *BBS via America Online: Keyword "Ham", Select "Hamvention". Phone: (513) 276-6930;* or write to *Hamvention, Box 964, Dayton OH 45401-0964.* For advance registrations, make checks payable to *Dayton HAMVENTION* and mail to *Dayton Hamvention Box 1446, Dayton OH 45401-1446.* License Exams by appointment only. Call *FAXMail (513) 276-6934, or BBS* for details

SPECIAL EVENT STATIONS

NOV 26-27

WHITMAN, MA The Whitman ARC, Inc. will operate WA1NPO at Plimoth Plantation in Plymouth MA to commemorate Thanksgiving Day. Freq.: 3.970, 7.270, 14.270, 18.140, 21.370,24.970, and 28.370. Operation will be 1400Z- 2100Z both days. For a 7 1/2" x 10" Certificate with the Mayflower II in the background, send an SASE to *Whitman ARC, P.O. Box 48, Whitman MA 02382.*

DEC 2

SAN ANGELO, TX The San Angelo ARC will operate W5QX Dec. 2nd 1500Z-2200Z Dec. 4th, to celebrate Christmas at Old Fort Concho. Operation will be in the General portions of the 40, 20, 15m subbands, and the Novice 10m subband. For a certificate, send 9" x 12" SASE to *AB5BG, 1210 Ardmore, San Angelo TX 76905.*

DEC 10-11

BETHLEHEM, IN The Clark County ARC will operate W9WWI to celebrate the Holiday Season. Operation will be in the General 80-15m phone band, the Novice 10m subband, and on 2m. For a certificate, send QSL and SASE to *CCARC, P.O. Box 532, Jeffersonville IN 47130.*

KIMBERLING CITY, MO The Kimberling ARC will operate NQ0G from 1500Z-1900Z both days (Dec. 10 & 11). Operation will be from the Port of Lights, a 1 1/2 mi. drive through an animated Wonderland of Lights. This event is being sponsored by Table Rock Lake/Kimberling City Area Chamber of Commerce. Look for them in the lower portions of the 80, 40, 20, and 15m bands. For a certificate, send QSL and SASE to *Chamber of Commerce, P.O. Box 495, Kimberling City MO 65686.*

DEC 17-18

NAZARETH, PA The Delaware-Lehigh ARC will operate W3OK 1400Z-0200Z Dec. 17-18 from the Christmas City. Frequencies: 3.965, 7.265, 14.265, 21.365 and 28.365. For a certificate, send QSL and SASE to *DLARC, RD4, Greystone Bldg., Nazareth PA 18064.*

JAN 1

LOS ANGELES, CA The Spanish Int'l Western ARC will operate from Los Angeles CA USA, and from Central and South America 1600 UTC-2400 UTC to celebrate "Feliz Ano Nuevo America." Frequencies: 21.340 USB and 7.260 LSB MHz. Listen for Stations N6TOO, KC6GJD, N6TBX/TG8 and LU9FAN. For a certificate, send QSL to *Spanish Int'l Western ARC, P.O. Box 2082, Seal Beach CA 90740 USA.*

What You Missed in 73 Amateur Radio Today

If you don't read the November issue of *73*, here's what you'll be missing:

• Build your own Average and Peak Reading RF Power Meter! Marion Kitchens K4GOK takes you through construction of this simple circuit, based on the LM3900 op amp. Construction is easy on a custom PCB or perfboard. Add this handy monitor to you operating table!

• Build a 440 MHz base or repeater antenna for less than 10 bucks! Marty Gammel KAØNAN helps you create your own omnidirectional UHF stick with easy-to-find parts. The antenna is compact and weatherproof, completely encased in PVC pipe.

• Adapt cheap Bell 202 telephone modems for packet. Here is an inexpensive way to test the waters in packet radio. Robert Whitaker KI5PG shows you how to convert these common surplus units for amateur use.

• *73* always brings you the best reviews. In the November issue you'll find an in-depth look at the new Kenwood TS-60S 50 MHz all-mode transceiver. Steve Katz WB2WIK/6 takes you under the hood of this innovative rig.

• Ever see an HT with a built-in spectrum analyzer? Gordon West WB6NOA reviews the new DJ-G1T handheld from Alinco.

• How about building a single-band CW QRP rig? Jeff Gold AC4HF reviews the MXM Simple Transceiver Kit in the November *73*.

• You expect to find the best columns in *73* and we won't let you down!

• Joe Carr K4IPV gives you the ins and outs of loop antennas in "Carr's Corner."

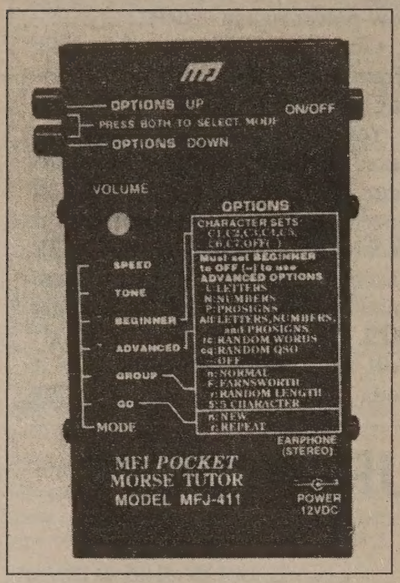
• Mike Bryce WB8VGE shares tips on modifying popular Heathkit low-power rigs in "QRP."

• Joe Moell KØOV tests Motron's Transmitter Fingetprinter in "Homing In."

You should read the November issue, and every issue of, ***73 Amateur Radio Today!*** Order now and save $15 off the cover price. You'll receive a one-year subscription (12 issues in all) to the best ham magazine money can buy, for just $19.97. For instant service call toll-free (800) 289-0388. Do it today! RF

new products

MFJ ENTERPRISES



Here comes an excellent opportunity for you to learn or to perfect your Morse code skills! The MFJ-411 Personal Morse Code Tutor will take you from zero to expert speed, from beginner to Extra Class, utilizing a custom code practice technique.

The Random QSO Mode allows you to start by practicing plain English QSOs to get you ready for the FCC exams; the Word Recognition Mode allows you practice copying entire words—just like the pros on 40 meters!

You can take the 411 anywhere—it measures only 3" x 1-1/8" x 5-1/2" The Tutor runs off a 9V battery or from the optional MFJ-1312B 110V adapter. You can use it with the built-in speaker or with earphones.

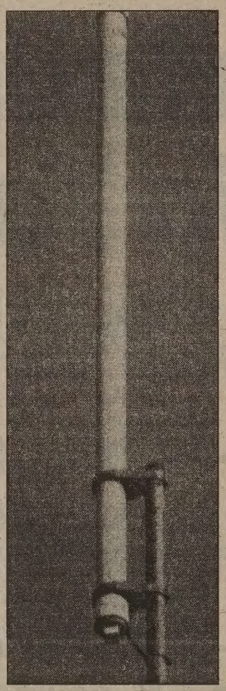
The MFJ-411 Personal Morse Code Tutor is priced at $79.95. For more information or to order contact your favorite dealer or *MFJ Enterprises, Inc., P.O. Box 494, Mississippi State, MS 39762; (601) 323-6551, or (800) 647-1800.* Or circle Reader Service No. 201.

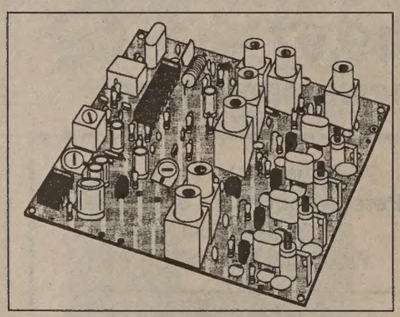
JADE PRODUCTS

The new series of Jade-Pole Antennas from Jade Products is based on a conventional J-pole design using ladder-line technology. They are available for the 2 meter, 220 MHz, and 6 meter bands.

The Jade-Poles are constructed of heavy-duty #18 copper-clad steel conductor and come with a standard SO-239 connector. The antenna is rated at 300 watts and is usable over the entire band of operation using a 50 ohm coax feedline.

The 2 meter and 220 MHz versions come completely assembled and ready for installation; minor assembly is required for the 6 meter version—complete instructions are included. The antenna is colored white and comes ready to mount on a wall or onto a mast with the optional mast mounting kit. The 2 meter version is priced at $28.95, the 220 MHz version is $27.95, and the 6 meter version is $37.95. For more information contact *Jade Products, P.O. Box 368, E. Hampstead, NH 03826-0368; (603) 329-6995, FAX (603) 329-4499.* Or circle Reader Service No. 203.





HAMTRONICS

If you are looking for an inexpensive but very effective wideband FM receiver for 137 MHz weather fax reception, the new R138 Receiver from Hamtronics may be the answer. Because a wide IF bandwidth is required in this type of receiver for good quality reception, many conventional receivers and scanners are unsuitable without modification.

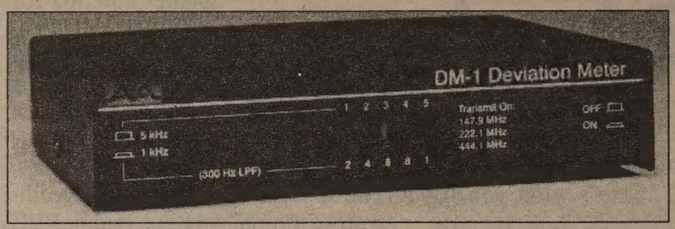
The R138 Receiver is crystal controlled; it has four channel oscillators, which allow you to select a particular satellite by simply grounding the appropriate control line by an external switch. Crystals are available for all the popular satellites and simply plug into sockets. The receiver also has very good sensitivity, typically 0.2 µV.

The kit price is $99, or wired and tested for $169. For more information, catalogs, or to order contact *Hamtronics, Inc., 65-D Moul Rd., Hilton, NY 14468-9535; (716) 392-9430, FAX (716) 392-9420.* Or circle Reader Service No. 206.

COMTREK

ComTrek, a new Windows terminal program for the Kantronics KPC-3, is a user-friendly software program for packet radio communication. It features split screen, 400 line scroll-back buffer, user-programmable auto connect and macro screens, save-to-file and print screens, on-line editor, and many other features. Files can be uploaded from disk, or directly from the editor.

The ComTrek program is full color or gray scale and has 3D command buttons across the top of the screen for the most often used commands. This is the latest software program from ComTrek for anyone using a KPC-3 who has an IBM or compatible computer running Windows. The price is $29.95, shipping included (within the US). For more information or to order contact *ComTrek, P.O. Box 4101, Concord, NH 03302-4101.* Or circle Reader Service No. 208.

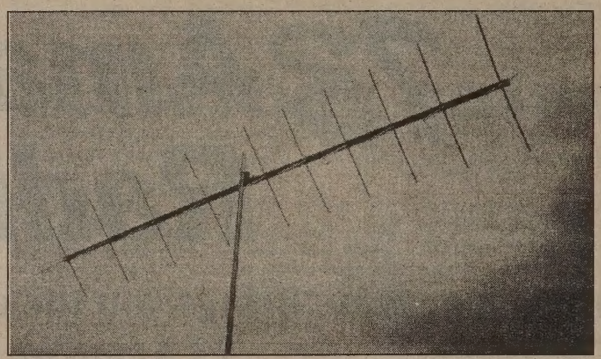


ADVANCED ELECTRONIC APPLICATIONS

The new AEA DM-1 Deviation Meter is designed for measuring the deviation of FM transmitters operating in the 144, 220, or 440 MHz amateur bands. "The people using 9600 baud TNCs will benefit most from the DM-1," explained AEA's Kevin Cox, "because correctly setting deviation for 9600 baud packet operation is nearly impossible to do by ear." The DM-1 allows you to easily set deviation, eliminating excessive retries, increasing data throughput, and increasing channel efficiency.

The DM-1 has crystal-controlled tuning, providing for stable measurement without the need for manual tuning. It comes with a 10-segment LED bar display, and has an external output for digital or analog meters.

The AEA DM-1 Deviation Meter is priced at $169. For more information or to order visit your favorite dealer or contact *Advanced Electronic Applications, Inc., P.O. Box C2160, Lynnwood, WA 98036; (206) 774-5554, FAX (206) 775-2340.* Or circle Reader Service No. 202.



LIGHTNING BOLT ANTENNAS

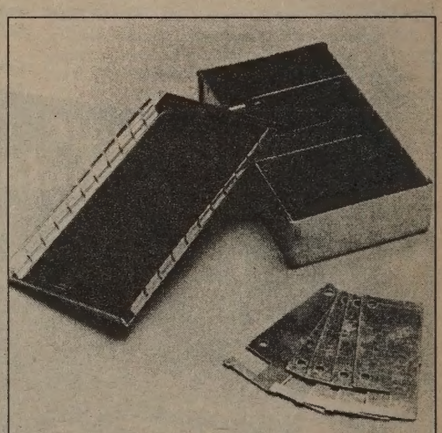
Lightning Bolt Antennas has added two new 10-element quad antennas to their product line. The 2 meter quad has a measured gain of 14 dBd. It is equipped with a 12-foot filament-wound Fiberglas boom and solid 3/8" Fiberglas spreader arm rods. These spreaders are slotted on the ends so the wire elements pop on with tension—they hold tight. A 220 MHz version is also available.

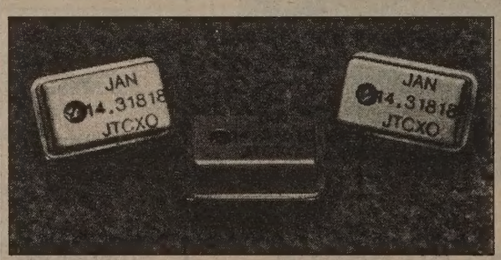
These antennas come complete with stainless steel hardware and an aluminum boom-to-mast bracket. They are priced at $99.95 for either model. For more information or to order contact *Lightning Bolt Antennas, Rd. 2, Rt. 19, Volant, PA 16156; (412) 530-7396.* Or circle Reader Service No. 204.

SESCOM

Home-brewers can keep the RF from getting into or out of their latest project with an RF tight, hot tin plated steel box from SESCOM. The new SB series of RF Shielded Steel Boxes allow the designer to eliminate the typical spillover of unwanted signals. The boxes come with individual dividers and the lids can be soldered to the case.

Eleven sizes are stocked, ranging from 2.1" x 1.9" x 1.0" to 6.4" x 2.7" x 1.1" and are priced from $4.50 to $13.20. For more information, to request a 1995 catalog, or to order contact *SESCOM, Inc., 2100 Ward Drive, Henderson, NV 89015-4249; (702) 565-3400, FAX (702) 565-4828.* Or circle Reader Service No. 205.





JAN CRYSTALS

JAN Crystals is now offering a line of Temperature Controlled Crystal Oscillators (TCXOs). JAN's TCXOs maintain a very stable frequency as ambient temperature changes, making them ideal for use in FM modulators, pulse code modulators, video cameras, measurement systems, portable radios, and a host of other projects.

The oscillators operate in a frequency range of 10 to 20 MHz and provide frequency stability of ± 2.5 ppm over a temperature range from -30°C to 75°C. Complete specifications and further information is available by contacting *JAN Crystals, P.O. Box 60017, Fort Meyers, FL 33906-6017; (800) JAN-XTAL.* Or circle Reader Service Card No. 207.

"Built-in VOX? Right!"

"Dual Decode. Now that's a first!"

"Wow, a real Battery Voltage Readout!"

"Yaesu did it again!"

FEATURES	Yaesu FT-530	Kenwood TH-78A	Alinco DJ-580	Icom IC-W-21AT
Memory Channels	82	50	40	70
Slide-out Lithium Battery	YES	NO	NO	NO
Dual CTCSS Decoder	YES	NO	NO	NO
Battery Voltage Readout	YES	NO	NO	NO
Automatic CTCSS Tone Search	YES	NO	NO	NO
Transmit Battery Saver (Repeater & Simplex Operation)	YES	NO	NO	NO
Built-In Vox	YES	NO	NO	NO
One Touch Reverse Button	YES	NO	NO	NO
Dual In-Band Receive (V+V, U+U)	YES	YES	NO	YES
Programmable External Speaker Audio	YES	NO	NO	NO
Optional Digital Display Mic with "S" Meter	YES	NO	NO	NO
AM Aircraft Receive	YES	YES	YES	YES

The Best vs. "the rest".

FT-530
Dual Band Handheld

- **Frequency Coverage:**
  2-Meter 130-174 MHz RX
  144-148 MHz TX
  70 cm 430-450 MHz RX/TX
- 4 TX Power levels:
  w/FNB-25: 2.0, 1.5, 1.0, 0.5W
  w/FNB-27: 5.0, 3.0, 1.5, 0.5W
- DTMF Paging and Coded Squelch
- AOT – Auto On-Timer with built-in clock and alarm functions
- IBS – Intelligent Band Select (provides automatic TX band select on scan stop)
- Backlit keypad and display with time delay
- Built-in cross-band repeat function
- APO – Automatic Power Off
- 5 Watts output w/ FNB-27 battery or 12 VDC
- 2 VFO's for each band
- **Accessories:**
  NC-42 1-Hour Desk Charger
  FNB-25 600 mAh Battery (2 watt)
  FNB-26 1000 mAh Battery (2 watt)
  FNB-27 600 mAh Battery (5 watt)
  FBA-12 6 AA Cell Holder
  CSC-56 Vinyl Case w/ FNB-25
  CSC-58 Vinyl Case w/ FNB-26/27
  E-DC-5B 12 VDC Adaptor
  YH-2 Headset for VOX
  MH-12A2B Speaker Mic
  MH-18A2B Lapel Speaker Mic
  MH-19A2B Mini Earpiece Mic
  MH-29A2B LCD Display Mic with Remote Functions
  MMB-54 Mobile Mounting Hanger

No other dual band handheld beats the FT-530 on features for performance and ease of use. With the largest backlit keypad available, 82 memories, exclusive Dual CTCSS Decode and AM Aircraft Receive, the FT-530 is simply the best value there is.

Compare for yourself, then forget "the rest." See your dealer for the best dual band handheld you can buy. The FT-530.

YAESU

Performance without compromise.℠

Specifications subject to change without notice. Specifications guaranteed only within amateur bands. Some accessories and/or options are standard in certain areas. Check with your local Yaesu dealer for specific details.

On-Board Guidance System

99¢
for a DELUXE CORDURA SOFT CASE with purchase of a TH-79A, now through Dec. 31, 1994
See Kenwood dealer for details

New TH-79A
FM DUAL BANDER

Information at your fingertips. Everything you need to know about operating the new TH-79A FM dual-bander (144MHz/440MHz) can be viewed in its unique dot-matrix LCD with alphanumeric display. No need for the manual. In addition to this innovative guide function, the TH-79A sports a user-friendly menu system, providing easy access to the many powerful features of this slim-line handheld transceiver. Such as 82 non-volatile memory channels with ID, DTSS and page functions, and a DTMF memory function for auto-dial operation. Full-crossband duplex operation is available, as is the ability to receive two frequencies on the same band (VHF+VHF or UHF+UHF) simultaneously. And thanks to the FET power module, long hours of operation are possible on one charge. With the TH-79A, transceiver technology enters the 21st century.

Features

- 2.7W output (144MHz), 2W output (440MHz) from MOS FET power module and supplied 6V battery; 5W output using optional PB-34
- Dot-matrix LCD with menu/guide system
- 82 non-volatile memory channels with ID
- DTMF keypad with memory function
- DTSS (Dual-Tone Squelch System) with page
- Built-in CTCSS tone encoder/decoder
- Automatic band change
- Power-on call sign display
- Auto repeater offset (VHF)
- Input overvoltage warning
- 3-position output power control
- Auto power-off and battery save function
- Time-out timer
- Multiple scan modes
- Cross-band repeater function
- Page answer-back function
- Channel display function
- Wideband receiver coverage, including AM receive on the aircraft band*
- Modifiable for MARS/CAP use**

*Specifications guaranteed for Amateur bands only.
**Permits required. Specifications guaranteed for Amateur bands only.

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AMATEUR RADIO PRODUCTS GROUP
P.O. BOX 22745, 2201 East Dominguez St., Long Beach, CA 90801-5745
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